

1961

Arkansas Academy of Science Proceedings - 15 1961

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ACADEMY OF SCIENCE
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1961 ✓

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**ARKANSAS
ACADEMY OF SCIENCE**

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Volume XV 1961

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ARKANSAS ACADEMY OF SCIENCE

Forty-fifth Annual Meeting
University of Arkansas
April 14-15, 1961

OFFICERS

President Herman L. Bogan
President-Elect Truman McEver
Secretary R. Reece Corey
Treasurer Robert S. Fairchild

SECRETARY'S REPORT

The first business meeting was called to order by President Herman Bogan at 11:00 A.M., April 14, 1961, with 33 members present. Dr. Robert Willard welcomed the academy and its affiliated groups to the campus of the University of Arkansas.

The Secretary's Report, read by Dr. Corey, was accepted. No Treasurer's Report was given as the Treasurer was absent due to illness. Dr. Noyce, as Editor-in-Chief, called attention to the editorial policy requiring papers to be submitted for publication at the time of presentation, and he called a meeting of the Editorial Board for 4:30 P.M., after the section meetings.

The Secretary reported that AAAS research grants of \$25.00 were awarded to:

Ronald G. Embry
3106 Oak Grove Street
Fort Smith, Arkansas

Martha Moore
University of Arkansas
Fayetteville, Arkansas

Larry I. Newton
547 South Garfield Street
Piggott, Arkansas

Jim Porter
University of Arkansas
Fayetteville, Arkansas

The special award for meritorious High School students was given to Steve Douglas, 3623 Marshall Drive, Fort Smith, Arkansas.

ARKANSAS ACADEMY OF SCIENCE

President Bogan announced that the report of the Committee to study Science Education in Arkansas would be given as a part of the program of the Education Section. President Bogan announced that the National Science Foundation had renewed its grant of support to the Visiting Scientist Program of the Academy, and he briefly explained how the program, which is administered by Dr. Keesee, operates.

President Bogan appointed several ad hoc committees.

Nominations:	Sam Siegel, Chairman, D. R. Albin, and Dwight Moore.
Auditing:	W. P. Boyer, Chairman, and Francis Clayton.
Meeting Place:	R. W. Shideler, Chairman, W. J. Broach, and Neil Fulton.
Resolutions:	Charles C. Smith, Chairman, K. R. Walker, and D. W. Mathews.

Dr. Paulissen stated that winners of the Arkansas Science Talent Search have in the past been awarded a subscription to Science News Letter and the equivalent of a round trip bus fare from their home to the meeting site, and he moved that these awards be made annually on a continuing basis. The motion carried.

President Bogan announced that the President of the Arkansas Academy of Science had been invited to attend the installation of President Mullins of the University of Arkansas on April 24. He announced that either the President or President elect would attend depending on the circumstances.

Upon recommendation of the Executive Committee the possibility of combining the offices of secretary and treasurer was explored. A motion to this effect was made by Dr. Bailey with second by Dr. Fry. After discussion the motion was withdrawn.

Dr. Fry brought up the question of whether the Treasurer is now or should be bonded, considering the amount of funds required by the Visiting Science Program. Dr. Noyce suggested the matter be referred to Dr. Keesee.

With no further business the meeting was adjourned at 11:55 A.M.

The second business meeting was called to order by President Herman Bogan at 9:55 A.M. April 15, with 31 members present.

Dr. Amis moved that all new members be accepted. The motion carried.

Dr. McCarty brought up the question of whether the Academy

and the Science Fair should be held on separate dates. Dr. Howick moved, and Dr. McCarty seconded, that a committee be appointed to study the feasibility of the Academy and the Science Fair meeting at different dates or places. A committee of Mr. Berry, Dr. Pryor, and Miss Reid was appointed.

Dr. Wills reported on the activities of the Collegiate Academy.

As chairman of the Meeting Place Committee, Dr. Shideler moved that the next meeting be held at Harding College with the date to be set subsequently. Tentative acceptance for Harding College was given by Dr. Sears.

Dr. Bailey moved that the President commend Alpha Chi Sigma and Sigma Phi Sigma for their assistance with the Science Fair.

The Nominating Committee presented the following slate for officers:

Editor	W. K. Noyce
Treasurer	E. E. Dale
Secretary	R. R. Corey
President-elect	R. W. Shideler

A motion that the slate be accepted was made by Dr. Amis. The motion carried.

As chairman of the Nominating Committee, Dr. Siegel moved that President-elect McEver be confirmed as President. The motion carried unanimously.

Dr. Amis moved, with Dr. Shideler's second, that a post of Historian be established, and that Dr. Dwight Moore be elected Historian. The motion was carried.

A motion by Dr. Bailey to have the Publicity Committee continued was carried. Dr. Sears was reappointed as Publicity Chairman.

With no further business the meeting was adjourned at 10:45 A.M.

Respectfully submitted,

R. Reece Corey
Secretary

ARKANSAS ACADEMY OF SCIENCE

PROGRAM**Friday, April 14**

- 9:00 a.m. to
2:30 p.m. Registration, Foyer of Chemistry Building.
- 10:45 a.m. Business Meeting, Auditorium in Business Administration Building.
- 12:00 Noon Luncheon, Brough Commons, for Collegiate and Senior Academy delegates.
- 1:15 p.m. Science Education Section, Chemistry Building.
"Science Education Programs in Progress in Arkansas," Lowell F. Bailey, University of Arkansas, in charge of program.
- 2:30 p.m. to
4:30 p.m. Section Meetings.
- 4:30 p.m. Arkansas Science Teachers Association Meeting, Physics Building.
- 5:30 p.m. Banquet, Uark Bowl.
- 6:30 p.m. to
7:30 p.m. Science Fair Awards, Uark Bowl.
- 8:00 p.m. Address, Business Administration Auditorium,
"On the Superior Galactic Communities,"
Dr. Paul Kuroda, University of Arkansas.
- 7:00 p.m. to
10:00 p.m. Science Fair Exhibit, Men's Gymnasium.

Saturday, April 15

- 8:45 a.m. Business Meeting, Auditorium in Business Administration Building. Treasurer's report and reports of standing committees and special committees. Election of officers. Location of next year's meeting. New Business. Installation of Officers.
- 10:00 a.m. General Session with the Junior and Collegiate Academies, Business Administration Auditorium. Papers by Science Talent Search Winners. L. J. Paulissen, Director of State Science Talent Search, in charge.

ARKANSAS ACADEMY OF SCIENCE

SECTIONAL PROGRAM**Biology and Agriculture**

Chairman: R. K. Strawn
University of Arkansas

EFFECTS OF TEMPERATURE AND DISSOLVED SOLIDS ON THE SURVIVAL OF BRINE SHRIMP NAUPLII. Merle Bull, University of Arkansas.

A REVISED CATALOG OF THE GRASSES OF ARKANSAS. Dwight Moore, Arkansas A. and M. College.

PROGRESS REPORT ON THE STUDIES OF INTERGRADATION OF SUBSPECIES OF EURYCEA LONGICAUDA. Charles C. Smith, Arkansas College.

THE OCCURRENCE OF A GROWTH INHIBITOR IN DORMANT BUDS OF WOODY SPECIES. Billy W. Bagley, University of Arkansas.

THE ISOLATION OF GROWTH INHIBITORS FROM DORMANT MAPLE BUDS. Forrest Lane, University of Arkansas.

SOME ECOLOGICAL ASPECTS OF AN ARKANSAS STREAM WITH REFERENCE TO TROUT PRODUCTION. Robert R. Van Kirk, University of Arkansas.

AN AGED BOX TURTLE IN ARKANSAS. Douglas James, University of Arkansas.

THE FLUORESCENT ANTIBODY TECHNIQUE - A NEW CLINICAL TOOL IN DIAGNOSTIC MICROBIOLOGY. David A. Beeker, University of Arkansas.

ACCUMULATION OF RARE EARTH ELEMENTS BY MICROORGANISMS. G. T. Johnson, University of Arkansas.

Chemistry

Chairman: L. Howick
University of Arkansas

Division A. Moderator: L. Howick

THE UNDERGRADUATE CURRICULUM AT THE UNIVERSITY OF ARKANSAS. L. Howick, University of Arkansas.

CURRICULUM PROBLEMS IN THE DEVELOPMENT OF A FOUR-YEAR PROGRAM IN CHEMISTRY. Wilson J. Broach and Billie G. Broach, Little Rock University.

THE NSF UNDERGRADUATE RESEARCH PARTICIPATION PROGRAM IN CHEMISTRY AT THE UNIVERSITY OF ARKANSAS. Arthur Fry, University of Arkansas.

THE USE OF SEMINAR AT ARKANSAS STATE COLLEGE. Howard Moore, Arkansas State.

THE PURPOSE, GOALS, AND ACHIEVEMENTS OF THE GRADUATE INSTITUTE OF TECHNOLOGY. D. M. Mathews, Graduate Institute of Technology.

S₄N₄ AND S₄N₃ Br STRUCTURES. Ronald R. Goforth, University of Arkansas.

THE INFRA-RED SPECTRA OF SOME CHEMISORBED MOLECULES. Laurence Neff, University of Arkansas.

Division B. Moderator: A. W. Cordes

A METHOD FOR DETERMINING POSSIBLE SOLVATION NUMBERS IN MIXED SOLVENTS. James O. Wear, University of Arkansas.

DIELECTRIC CONSTANTS IN POLAR SOLVENTS. Boyce Helms, University of Arkansas.

THE KINETICS OF THE SOLVOLYSIS OF SUCROSE. D. M. Mathews and Charles Reed, Graduate Institute of Technology.

THE EFFECT OF THE BINDING OF CU(II) AND CO(II) IONS ON BOVINE PLASMA ALBUMIN AT LOW pH. Wilbur W. Everett, Gerontology Branch, National Heart Institute PHS., D. H. E. and W., Bethesda, and Baltimore City Hospitals, Baltimore, Maryland, and Ouachita Baptist College.

THE AMIANTHIUM ALKALOIDS, PART I. ACIDS FROM HYDROLYSIS OF ALKALOID E. Don England, University of Arkansas and Harding College.

SUBSTRATE SPECIFICITY OF DIHYDROXY ACID DEHYDRASE IN VALINE BIOSYNTHESIS. James W. Blankenship and Robert L. Wixom, University of Arkansas Medical Center.

SYNTHESIS OF ADENINE IN ALLOXAN DIABETES. Waldean G. Rapp, University of Arkansas.

Division C. Moderator: D. G. Gardner

14 - MEV NEUTRON INDUCED FISSION OF U²³⁸. Knox M. Broom, University of Arkansas.

HIGH-ENERGY ELECTRON BOMBARDMENT OF CYCLOPROPANE IN THE PRESENCE OF RARE GAS SENSITIZED H ATOMS. F. W. Lampe and C. Fred Smith, University of Arkansas.

REMARKS ON LIQUID SCINTILLATION COUNTING SYSTEM. R. J. Douthart, W. Lohman, and W. Broach, Little Rock University.

ON THE AGE OF THE SOLAR SYSTEM. O. K. Manuel, University of Arkansas.

FALLOUT FROM NUCLEAR DETONATIONS OF FEBRUARY AND APRIL 1960. Howard L. Hodges, University of Arkansas.

NATURAL AND ATMOSPHERIC OCCURRENCE OF RADIOCERIUM. M. P. Menon, University of Arkansas.

EQUILIBRIUM RELATIONSHIPS BETWEEN RADON AND ITS DECAY PRODUCTS. John L. Meason, University of Arkansas.

Geology

Chairman: James H. Quinn
University of Arkansas

SOME ASPECTS OF GEOLOGY AS A SERVICE TO THE PUBLIC. Robert J. Willard, University of Arkansas.

LATE PALEOZOIC AMMONOIDS OF THE AMERICAN MID-CONTINENT REGION. Mackenzie Gordon, Jr., U. S. Geologic Survey.

SOME SPECIAL PALEONTOLOGIC PROBLEMS IN THE PENNSYLVANIA ROCKS OF NORTHWEST ARKANSAS. Lloyd G. Henbest, U. S. Geologic Survey.

GEOLOGIC SECTION OF BRADLEY? CALHOUN? OUACHITA, AND PART OF NEVADA COUNTIES, ARKANSAS. D. R. Albin, Groundwater Branch, U. S. Geologic Survey.

History and Political Science

Chairman: Keith Peterson
University of Arkansas

MISSOURI: A SOUTHERN OR A MIDWESTERN STATE? Kenneth R. Walker, Arkansas Polytechnic College.

STATE PARTY ACTIVITY IN A TWO-PARTY ENVIRONMENT: THE DEMOCRATIC PARTY OF INDIANA. George C. Roberts, University of Arkansas.

AN APPLICATION OF THE THEORY OF SOCIAL MOBILIZATION TO ARKANSAS. Gene E. Rainey, Harding College.

Mathematics Section

Chairman: Charles Pitner
Harding College

LECTURE ON COMPUTER PROBLEMS FOLLOWED BY A DEMONSTRATION AT THE COMPUTER CENTER. James Scroggs, University of Arkansas.

ARKANSAS ACADEMY OF SCIENCE

Physics

Chairman: M. L. Lawson
Harding College

RESTRICTED DIFFUSION OF MACROMOLECULES THROUGH AGAR GELS. Gary Akers, Harding College.

MEASUREMENT OF ATOMIC LIFETIMES. William R. Pendleton, University of Arkansas.

POLARIZATION OF OPTICAL RADIATION INDUCED BY ELECTRON IMPACT (Part I). Lawrence D. Weaver, University of Arkansas.

POLARIZATION OF OPTICAL RADIATION INDUCED BY ELECTRON IMPACT (Part II). Richard B. Kay, University of Arkansas.

SOME OPTICAL PROPERTIES OF IRRADIATED LUCITE. A. Poularikas, University of Arkansas.

Science Education

Chairman: Lowell F. Bailey
University of Arkansas

REPORTS FROM COMMITTEES INVOLVED IN CURRICULUM STUDY.

REVISED AND ANNOTATED CATALOGUE OF THE GRASSES OF ARKANSAS

Dwight Munson Moore
Arkansas A. & M. College

In 1941 the writer published in the Proceedings of the Arkansas Academy of Science, Vol. I, A Check List of the Grasses of Arkansas(3), according to the records at that time. Since then, considerable study has increased our knowledge (4,5,6) of this large and important group of plants to such an extent that it seems desirable to bring this material together into a convenient and usable form.

The following catalogue represents the efforts of many workers in addition to that of the writer. Acknowledgment is extended to Dr. Etlar L. Nielsen, Dr. Delzie Demaree, Mr. E. J. Palmer, and others, including several men in the Soil Conservation Service, particularly Hurlon C. Ray and Marvin Lawson. Dr. J. R. Swallen and Mrs. Agnes Chase, of the National Herbarium, have confirmed identifications and furnished data not otherwise available. To all of these and many others, thanks are hereby extended.

The nomenclature and the order of presentation follow the Manual of the Grasses of the United States, by A. S. Hitchcock, as revised by Mrs. Agnes Chase in 1951(2). Collections are indicated generally by counties. Many species may occur in counties not enumerated.

SUBFAMILY 1. FESTUCOIDEAE.

Tribe 1. Bambuseae.

1. Arundinaria gigantea (Walt.) Muhl. Giant Cane. General. (Includes previous reports as A. macrosperma Michx. and A. tecta (Walt.) Muhl.)

Tribe 2. Festuceae.

Bromus. Brome grass.

2. B. catharticus Vahl. Rescue Grass. Introduced and widely escaped.
3. B. purgans L. Canada Brome. Moist woods and rocky slopes.
4. B. nottowayanus Fernald. Faulkner.
5. B. secalinus L. Chess, Cheat. Common weed.
6. B. commutatus Schrad. Hairy Chess. Common weed.
7. B. mollis L. Soft Chess. Pulaski.

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8. B. racemosus L. Pulaski.
9. B. japonicus Thunb. Japanese Chess. Common.
10. B. rigidus Roth. Ripgut grass. Southeastern Conway County, east of Menifee.
11. B. sterilis L. Barren Bromegrass. Benton, Carroll, and Washington.
12. B. tectorum L. Downy Chess. Common weed.

Festuca L. Fescue

13. F. octoflora Walt. Six-weeks Fescue. General.
14. F. octoflora var. glauca (Nutt.) Fernald.
15. F. sciurea Nutt.
16. F. megalura Nutt. Foxtail Fescue. Hot Spring.
17. F. dertonensis (All.) Aschers. & Graebn. Pope, Van Buren, and Washington.
18. F. myuros L. Marion.
19. F. elatior L. Meadow Fescue. Washington.
20. F. arundinacea Schreb. Reed Fescue. Persisting after cultivation.
21. F. versuta Beal. Benton and Faulkner.
22. F. obtusa Bieler. Nodding Fescue. Ozark area.
23. F. paradoxa Desv. (F. shortii Kunth.) Benton, Garland, Greene, and Poinsett.
24. F. rubra L. Red Fescue. Persisting after cultivation.

Glyceria R. Br. Mannagrass

25. Glyceria arkansana Fernald. Conway, Garland, Jefferson, and Pulaski.
26. G. septentrionalis Hitchc. Eastern Mannagrass. Arkansas and Prairie.
27. G. fluitans (L.) R. Br. Mannagrass. Washington.
28. G. striata (Lam.) Hitch. Fowl Mannagrass. Northwestern half of state.

Poa L. Bluegrass

29. Poa chapmaniana Scribn. Ozark Mountain area.
30. P. annua L. Annual Bluegrass. Common weed in lawns and fields.
31. P. compressa L. Canada Bluegrass. Widely scattered.
32. P. arachnifera Torr. Texas Bluegrass. Craighead and Washington.
33. P. pratensis L. Kentucky Bluegrass. Common, especially in calcareous soils. Commonly used for lawns.
34. P. sylvestris A. Gray. Rich, moist or rocky woods.
35. P. bulbosa L. Bulbous Bluegrass. Introduced as a lawn-grass.

REVISED AND ANNOTATED CATALOGUE OF GRASSES

36. P. autumnalis Muhl. ex Ell. Central Arkansas.

Briza L. Quaking Grass

37. Briza minor L. Little Quaking grass. Southern Arkansas.

Eragrostis Beauv. Lovegrass

38. Eragrostis curtipedicellata Buckl.
 39. E. oxylepis (Torr.) Torr. Red Lovegrass.
 40. E. beyrichii J. G. Smith. Ouachita.
 41. E. glomerata (Walt.) L. H. Dewey. Southern Arkansas.
 42. E. reptans (Michx.) Nees. Edge of ponds and streams.
 43. E. hypnoides (Lam.) B. S. P. Wet ground.
 44. E. capillaris (L.) Nees. Lacegrass. Dry open ground.
 45. E. frankii C. A. Meyer. Sandbars, moist ground.
 46. E. pilosa (L.) Beauv. India Lovegrass. Moist soil.
 47. E. pectinacea (Michx.) Nees. Fields and waste places.
 48. E. cilianensis (All.) Lutati. Stinkgrass. Common weed.
 49. E. poaeoides Beauv. ex Roem. and Schult.
 50. E. arida Hitchc. Dry soil. Madison, Montgomery, and Pulaski.
 51. E. hirsuta (Michx.) Nees. Ozark and Ouachita Mountain areas.
 52. E. intermedia Hitchc. Plains Lovegrass. Scattered.
 53. E. trichodes (Nutt.) Wood. Logan and Pulaski.
 54. E. spectabilis (Pursh) Steud. Purple Lovegrass. General.
 55. E. refracta (Muhl.) Scribn. Ashley, Garland, and Nevada.
 56. E. curvula (Schrud.) Nees. Weeping Lovegrass. Introduced. Pope.

Diarrhena Beauv.

57. Diarrhena americana Beauv. Carroll and Newton.

Distichlis Raf. Saltgrass

58. Distichlis spicata (L.) Greene. (One specimen in the National Herbarium, by Chickering from "Ark" without location.)

Uniola L.

59. Uniola latifolia Michx. Broadleaf Uniola. Rich woods, along streams.
 60. U. sessiliflora Poir. Open woods, south Arkansas.
 61. U. laxa (L.) B. S. P. Common in low wet woods, southern Arkansas.

Dactylis L. Orchard Grass

62. Dactylis glomerata L. Orchard grass. Scattered. Escaped.

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Cynosurus L. Dogtail

63. Cynosurus echinatus L. Fulton, Hempstead and Washington. Introduced.

Arundo L.

64. Arundo donax L. Giant Reed. Planted and escaped.

Melica L. Melicgrass

65. Melica mutica Walt. Two-flower Melic. Rocky woods.
 66. M. nitens (Scribn.) Nutt. Three-flower Melic. Rocky woods.

Tridens Roem. and Schult.

67. Tridens elongatus (Buckl.) Nash. Rough Tridens. Carroll.
 68. T. chapmani (Small) Chase. Drew. (Considered as a variety of T. flavus by Shinnars(7))
 69. T. flavus (L.) Hitchc. Purpletop. Common throughout the state.
 70. T. strictus (Nutt.) Nash. Narrow Tridens. General.

Triplasis Beauv.

71. Triplasis purpurea (Walt.) Chapm. Purple Sandgrass. Ouachita.

Tribe 3. Hordeae.

Agropyron Gaertn. Wheatgrass

72. Agropyron repens (L.) Beauv. Quackgrass. North Arkansas.
 73. A. smithii Rydb. Western Wheatgrass. Escaped. North Arkansas.

Triticum L. Wheat

74. Triticum aestivum L. Wheat. Escaped.

Aegilops L. Goatgrass

75. Aegilops cylindrica Host. Jointed Goatgrass. Washington. Introduced.

Secale L. Rye

76. Secale cereale L. Rye. Escaped.

Elymus L. Wild-Rye

77. Elymus canadensis L. Canada Wild-Rye. North Arkansas.
 78. E. ----- var. brachystachys (Scribn. & Ball) Farwell.

Logan and Washington.

79. *E.* ----- var. robustus (Scribn. & Smith) Mackenz. & Bush. Pulaski.
80. *E.* glaucus Buckl. Logan. (In Arkansas recognized as *E. mackenzii* Bush.)
81. *E.* interruptus Buckl. Logan, Polk, and Scott.
82. *E.* riparius Wiegand. Scattered.
83. *E.* villosus Muhl. Benton, Carroll, Fulton, Izard and Washington.
84. *E.* ----- var. arkansanus Scribn. and Ball.
85. *E.* virginicus L. Virginia Wild-Rye. General.
86. *E.* ----- var. australis (Scribn. & Ball) Hitchc. Common.
87. *E.* ----- var. glabriflorus (Vasey) Bush. Common.
88. *E.* ----- var. intermedius (Vasey) Bush.

Hystrix Moench

89. *Hystrix* patula Moench. Bottlebrush grass. Common, woods.

Hordeum L. Barley

90. *Hordeum* jubatum L. Foxtail Barley. Garland.
91. *H.* pusillum Nutt. Little Barley. Common weed.
92. *H.* vulgare L. Barley. Escaped.
93. *H.* ----- var. trifurcatum (Schlecht.) Alefeld. Escaped.

Lolium L. Ryegrass

94. *Lolium* perenne L. Perennial Ryegrass. English Ryegrass. Escaped.
95. *L.* multiflorum Lam. Italian Ryegrass. Escaped.
96. *L.* temulentum L. Darnel. Little Rock and Stuttgart. Poisonous to livestock. (Supposed to be the "tares" sown by the enemy in the parable in the Scriptures.)

Tribe 4. Aveneae

Koeleria Pers.

97. *Koeleria* cristata (L.) Pers. Junegrass. Northwest Arkansas.

Sphenopholis Scribn. Wedgegrass

98. *Sphenopholis* filiformis (Chapm.) Scribn. Boone.
99. *S.* intermedia (Rydb.) Rydb. Slender Wedgegrass. Rocky woods.
100. *S.* longiflora (Vasey) Hitchc. Creek banks in woods.
101. *S.* nitida (Bieler) Scribn. Dry rocky woods.

102. S. obtusata (Michx.) Scribn. Prairie Wedgegrass. Open woods.

103. S. pallens (Bieler) Scribn. Van Buren County.

Deschampsia Beauv. Hairgrass.

104. Deschampsia flexuosa (L.) Trin. Crinkled Hairgrass. Magazine Mountain and Stone County.

Aira L.

105. Aira caryophyllea L. Silver Hairgrass. General, open areas.

106. A. elegans Willd. ex Gaudin. General.

Avena L. Oats

107. Avena sativa L. Oat. Escaped but seldom persistent.

Arrhenatherum Beauv.

108. Arrhenatherum elatius (L.) Presl. Tall Oatgrass. Escaped, Madison, Washington, and Yell.

Holcus L.

109. Holcus lanatus L. Velvet grass. Escaped, Garland and Washington.

Danthonia Lam. and DC. Oatgrass

110. Danthonia spicata (L.) Beauv. ex Roem. and Schult. Poverty Oatgrass: Common, dry, sterile soil.

Tribe 5. Agrostideae

Calamagrostis Adans. Reedgrass.

111. Calamagrostis canadensis (Michx.) Beauv. Bluejoint. Reported without location by Nuttall and Lesquereux, but not recently seen.

Agrostis L. Bentgrass

112. Agrostis alba L. Redtop. Commonly cultivated and escaped.

113. A. elliottiana Schult. Common.

114. A. hiemalis (Walt.) B.S.P. Open woods and fields.

115. A. palustris Huds. Creeping Bent. Escaped.

116. A. perennans (Walt.) Tuckerm. Autumn Bent. Open woods, fields.

117. A. scabra Willd. Garland.

118. A. tenuis Sibth.

Cinna L. Woodreed

119. Cinna arundinacea L. Stout Woodreed. Moist woods.

Limnodea L. H. Dewey

120. Limnodea arkansana (Nutt.) L. H. Dewey. Benton and Hempstead.

Alopecurus L. Foxtail

121. Alopecurus carolinianus Walt. Common in wet soil.

Polypogon Desf.

122. Polypogon monspeliensis (L.) Desf. Rabbitfoot grass. Conway, Faulkner, and St. Francis. Introduced.

Phleum L. Timothy

123. Phleum pratense L. Timothy. Cultivated for hay and commonly escaped.

Muhlenbergia Schreb. Muhly

124. M. brachyphylla Bush. Benton.
125. M. capillaris (Lam.) Trin. Hairawn Muhly. Benton, Drew, Marion, and Washington.
126. M. glabriflora Scribn. Hempstead.
127. M. mexicana (L.) Trin. Drew, Fulton, and Hempstead.
128. M. schreberi Gmel. Nimblewill. Northwestern half of state.
129. M. sobolifera var. setigera Scribn. Dry woods.
130. M. sylvatica (Torr.) Torr. Benton, Boone, Franklin, Lawrence, and Logan.
131. M. tenuiflora (Willd.) B.S.P. Baxter, Logan, Pope, and Stone.

Sporobolus R. Br. Dropseed

132. S. asper (Michx.) Kunth. Northwest and Southwest Arkansas.
133. S. asper var. hookeri (Trin.) Vasey. Garland.
134. S. asper var. pilosus (Vasey) Hitchc. Carroll.
135. S. clandestinus (Bieler.) Hitchc. Common.
136. S. contractus Hitchc. Spike Dropseed. Scattered.
137. S. cryptandrus (Torr.) A. Gray. Sand Dropseed. Clay, Hempstead, and Pulaski.
138. S. heterolepis (A. Gray) A. Gray. Prairie Dropseed. Prairies, northwest Arkansas.
139. S. neglectus Nash. Carroll, Pulaski, and Washington.
140. S. poiretii (Roem. & Schult.) Hitchc. Smutgrass. Common, south Arkansas.

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141. S. pulvinatus Swallen. Saline area near Charleston and Franklin County.
142. S. vaginiflorus (Torr.) Wood. Common in poor soil.
143. S. vaginiflorus var. ozarkanus (Fern.) Shinnery.

Brachyelytrum Beauv.

144. B. erectum (Schreb.) Beauv. Moist or rocky woods.

Stipa L. Needlegrass

145. S. avenacea L. Blackseed Needlegrass. Garland, Howard, Polk, Sevier, and Stone.

Aristida L. Three-awn.

146. A. curtissii (A. Gray) Nash. Logan and Washington.
147. A. dichotoma Michx. General.
148. A. intermedia Scribn. & Ball. Jefferson.
149. A. lanosa Muhl. ex Ell. Woolly Three-awn. Hempstead.
150. A. longespica Poir. Western Arkansas and Craighead County.
151. A. oligantha. Michx. Prairie Three-awn. General.
152. A. purpurea Nutt. Purple Three-awn. Izard.
153. A. purpurascens Poir. Arrowfeather. General.
154. A. ramosissima Engelm. ex A. Gray. Arkansas.
155. A. stricta Michx. Pineland Three-awn. Franklin and Pulaski.
156. A. virgata Trin. Drew and Independence.

Tribe 7. Chlorideae

Leptochloa Beauv. Sprangletop

157. L. fascicularis (Lam.) A. Gray. Sandbars along Arkansas River in Pulaski.
158. L. filiformis (Lam.) Beauv. Red Sprangletop. General.
159. L. panicoides (Presl) Hitchc. Rice region, southeast Arkansas.

Eleusine Gaertn.

160. E. indica (L.) Gaertn. Goosegrass. Common weed in lawns and fields.

Cynodon L. Rich.

161. C. dactylon (L.) Pers. Bermuda Grass. Commonly cultivated, escaped.

Schedonnardus Steud.

162. S. paniculatus (Nutt.) Trel. Tumblegrass. Poor soil,

Franklin, Marion, and Washington.

Spartina Schreb. Cordgrass

163. S. pectinata Link. Prairie Cordgrass. Arkansas, Prairie, Pulaski, and Washington.

Gymnopogon Beauv. Beardgrass

164. G. ambiguus (Michx.) B.S.P. Dry ground, coastal plain.
165. G. brevifolius Trin. Garland and Montgomery.

Chloris Swartz. Fingergrass

166. C. verticillata Nutt. Windmill grass. Marion and Washington.

Bouteloua Lag. Grama

167. B. curtipendula (Michx.) Torr. Side-oats Grama. Rocky hills, north and northwest Arkansas.
168. B. rigidiseta (Steud.) Hitchc. Calcareous soil, Little River County.
169. B. gracillis (H.B.K.) Lag. ex Steud. Blue Grama.

Buchloe Engelm.

170. B. dactyloides (Nutt.) Egel. Buffalo grass. Fulton and Sharp.

Tribe 8. Phalarideae

Anthoxanthum L. Vernalgrass

171. A. odoratum L. Sweet Vernalgrass. Washington.
172. A. aristatum Boiss. Mt. Nebb and Yell County.

Phalaris L. Canary grass

173. P. canariensis L. Canary grass. Carroll and Madison.
174. P. caroliniana Walt. Old fields throughout the state.
175. P. arundinacea L. Reed Canary grass. Washington. Escaped.

Tribe 9. Oryzeae

Oryza L. Rice

176. Oryza sativa L. Rice. Escaped in eastern Arkansas.

Leersia Swartz

177. L. lenticularis Michx. Catchfly grass. Wet ground, south Arkansas.
178. L. oryzoides (L.) Swartz. Rice Cutgrass. Wet ground,

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general.

179. L. virginica Willd. White-grass. Moist places, general.

Tribe 10. Zizanieae

180. Zizania L. Wildrice

Z. aquatica L. Reported by Nuttall and Lesquereux, but not confirmed recently.

Zizaniopsis Doell and Aschers

181. Z. miliacea (Michx.) Doell & Aschers. Southern Wildrice. Edges of lakes and bayous, coastal plain area.

SUBFAMILY 2. PANICOIDEAE

Tribe 12. Paniceae

Anthraenantia Beauv.

182. A. rufa (Ell.) Schult. Drew.

183. A. villosa (Michx.) Beauv. Reported by Nuttall as Panicum ignoratum.

Digitaria Heister. Crabgrass

184. D. sanguinalis (L.) Scop. Crabgrass. A very common weed.

185. D. ischaemum (Schreb.) Schreb. ex Muhl. Smooth Crabgrass. General.

186. D. ischaemum var. mississippiensis (Gattinger) Fernald. Jefferson.

187. D. violascens Link. Ashley, Fulton, Madison, and Marion.

188. D. filiformis (L.) Koel. Rocky open woods. Northwest Arkansas.

189. D. villosa (Walt.) Pers. Scattered.

Leptoloma Chase

190. L. cognatum (Schult.) Chase. Fall Witchgrass. Widespread.

Eriochloa H.B.K. Cupgrass

191. E. gracilis (Fourn.) Hitchc. Conway and Mississippi.

192. E. contracta Hitchc. Prairie Cupgrass. Miller.

Brachiaria (Trin.) Griesb.

193. B. ciliatissima (Buckl.) Chase. Benton.

194. B. platyphylla (Griseb.) Nash. Arkansas and Howard.

Axonopus Beauv.

195. A. furcatus (Flugge) Hitchc. Marshes and riverbanks, coastal plain.
196. A. compressus (Swartz) Beauv. Moist soil, coastal plain.
197. A. affinis Chase. Moist woods and ditches, coastal plain.

Paspalum L.

198. P. dissectum (L.) L. Garland and Logan.
199. P. fluitans (Ell.) Kunth. Benton County and coastal plain.
200. P. distichum L. Knotgrass. Chicot, Garland, Hempstead and Saline.
201. P. pubiflorum var. glabrum Vasey ex Scribn. Widely scattered.
202. P. pubescens Muhl. Common, open woods and fields.
203. P. ciliatifolium Michx. Sandy soil, Hempstead, Saline, and Washington.
204. P. dilatatum Poir. Dall's grass. Common, introduced.
205. P. urvillei Steud. Vasey grass. Ditches and wet soil, coastal plains.
206. P. laeve Michx. Widespread.
207. P. longipilum Nash. Faulkner and Garland.
208. P. circulare Nash. General.
209. P. floridanum Michx. General.
210. P. floridanum var. glabratum Engelm. ex Vasey. Conway, Logan, and Miller.
211. P. boscianum Flugge. Bull paspalum.
212. P. bifidum (Bertol.) Nash. Pitchfork paspalum.

Panicum L. Panic grass

Subgenus Dichanthelium Hitchc. and Chase

§ 1. Depauperata

213. Panicum depauperatum Muhl. Garland, Logan, and Pulaski.
214. P. perlongum Nash. Franklin, Marion, and Pulaski.
215. P. linearifolium Scribn. Rocky woods, general.
216. P. wernerii Scribn. Carroll, Garland, and Prairie.
217. P. xalapense H.B.K. General.

§ 2. Laxiflora

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218. *P. laxiflorum* Lam. Pulaski.

§ 3. *Angustifolia*

219. *P. aciculare* Desv. ex Poir. Ashley.
220. *P. chrysopsidifolium* Nash. Hempstead and Jefferson.
221. *P. consanguineum* Kunth. Miller.
222. *P. angustifolium* Ell. Conway, Hempstead, and Polk.
223. *P. arenicoloides* Ashe. Scattered.
224. *P. ovinum* Scribn. & Smith. Jefferson.

§ 4. *Bicknelliana*

225. *P. bicknellii* Nash. Garland.

§ 6. *Dichotoma*

226. *P. microcarpon* Muhl. ex Ell. General.
227. *P. nitidum* Lam. Craighead and Faulkner.
228. *P. dichotomum* L. General.
229. *P. barbulatum* Michx. Northern half of state.
230. *P. lucidum* Ashe. Arkansas, Greene, and Van Buren.

§ 7. *Spreta*

231. *P. spretum* Schult. Wet sandy soil, south Arkansas.
232. *P. lindheimeri* Nash. Scattered.

§ 8. *Lanuginosa*

233. *P. huachucae* Ashe. General.
234. *P. huachucae* var. *fasciculatum* (Torr.) Hubb. General.
235. *P. tennesseense* Ashe. Wooded hills.
236. *P. lanuginosum* Ell. Franklin and Logan.
237. *P. lanuginosum* var. *fasciculatum* (Torr.) Fern. Pulaski.
238. *P. auburne* Ashe. Faulkner and Washington.
239. *P. thurowii* Scribn. and Smith. Miller.
240. *P. praecocius* Hitchc. and Chase. Hempstead, Stone, and Washington.
241. *P. villosissimum* Nash. Faulkner, Pulaski, and White.
242. *P. pseudopubescens* Nash. Miller.

§ 10. *Sphaerocarpa*

243. *P. sphaerocarpon* Ell. General.
244. *P. polyanthes* Schult. Widespread.

§ 11. *Ensifolia*

245. *P. albomarginatum* Nash. Bradley.

§ 12. *Lancearia*

246. *P. webberianum* Nash. Washington.

REVISED AND ANNOTATED CATALOGUE OF GRASSES§ 13. *Oligosanthia*

247. *P. malacophyllum* Nash. Lawrence, Marion, Stone, and Washington.
 248. *P. helleri* Nash. Carroll.
 249. *P. scribnerianum* Nash. Common, open woods.
 250. *P. oligosanthos* Schult. Green, Hempstead, Logan, and Washington.
 251. *P. ravenelii* Scribn. & Merr. Garland, Miller, and Washington.

§ 14. *Pedicellata*

252. *P. pedicellatum* Vasey. Massard Prairie, Sebastian.

§ 15. *Scoparia*

253. *P. scoparium* Lam. Velvet panic. Wet places, common.

§ 16. *Commutata*

254. *P. ashei* Pearson. Scattered.
 255. *P. commutatum* Schulte. General.
 256. *P. mutabile* Scribn. & Smith ex Nash. Garland.
 257. *P. joorii* Vasey. Hot Spring and Union.

§ 17. *Latifolia*

258. *P. clandestinum* L. Rocky woods, scattered.
 259. *P. latifolium* L. Stone and Washington.
 260. *P. bosci* Poir. Northern two-thirds of state.
 261. *P. bosci* var. *molle* (Vasey) Hitchc. & Chase. Garland and Washington.

Subgenus *Eupanicum* Godr.§ 3. *Fasciculata*

262. *P. ramosum* L. Browntop millet. Waste ground.
 263. *P. texanum* Buckl. Texas millet. Pulaski and Washington.

§ 4. *Dichotomiflora*

264. *P. dichotomiflorum* Michx. Fall panic. General.

§ 5. *Capillaria*

265. *P. flexile* (Gattinger) Scribn. Northern counties.
 266. *P. gattingeri* Nash. Northern counties.
 267. *P. philadelphicum* Bernh. ex Trin. Northwest Arkansas.
 268. *P. capillare* L. Witchgrass. General.
 269. *P. capillare* var. *occidentale* Rydb. Washington.
 270. *P. hirticaule* Presl. Benton.

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§ 9. *Virgata*

271. *P. virgatum* L. Switchgrass. General.
272. *P. amarulum* Hitchc. & Chase. Escaped, Cleburne.

§11. *Agrostoides*

273. *P. agrostoides* Spreng. Ditches and edges of ponds, General.
274. *P. condensum* Nash.
275. *P. stipitatum* Nash. Coastal plain.
276. *P. longifolium* Torr. Saline.
277. *P. anceps* Michx. Common, wet ground.

§ 12. *Laxa*

278. *P. hians* Ell. General.

§ 13. *Verrucosa*

279. *P. verrucosum* Muhl. Ouachita.
280. *P. brachyanthum* Steud. Scattered.

§ 15. *Obtusa*

281. *P. obtusum* H.B.K. Vine-mesquite. Washington.

§ 17. *Gymnocarpa*

282. *P. gymnocarpon* Ell. Southern counties.
283. *P. antidotale* Retz. Blue Panic. Introduced.

Sacciolepis Nash.

284. *S. striata* (L.) Nash. Ouachita and Saline.

Oplismenus Beauv.

285. *O. setarius* (Lam.) Roem. & Schult. Open wet soil; Columbia, Hempstead, and Pike.

Echinochloa Beauv.

286. *E. colonum* (L.) Link. Jungle-rice. Wet land, southern Arkansas.
287. *E. crusgalli* (L.) Beauv. Barnyard grass. General.
288. *E. crusgalli* var. *mitis* (Pursh) Peterm. Northeast Arkansas.
289. *E. crusgalli* var. *zelayensis* (H.B.K.) Hitchc. Arkansas County.
290. *E. walteri* (Pursh) Heller. Crittenden.

Setaria Beauv. Bristlegrass; millet

291. *S. lutescens* (Weigel) Hubb. Yellow bristlegrass. Common.

292. S. geniculata (Lam.) Beauv. Knotroot bristlegrass. Northwest Arkansas.
293. S. verticillata (L.) Beauv. Bur bristlegrass. Washington.
294. S. magna Griseb. Giant bristlegrass. Drew and Washington.
295. S. viridis (L.) Beauv. Green bristlegrass. General.
296. S. faberii Herrm. Giant Foxtail. Tall weed, eastern Arkansas.

Pennisetum L. Rich

297. P. ciliare (L.) Link. Buffel grass. Introduced for trial for soil stabilization, but not established.

Cenchrus L. Sandbur

298. C. pauciflorus Benth. Field Sandbur. Scattered, in sandy soil.

Tribe 13. Andropogoneae

Erianthus Michx. Plumegrass

299. E. strictus Baldw. Narrow plumegrass. Wet woods, south Arkansas.
300. E. contortus Baldw. ex Ell. Bent-awn plumegrass. Open woods.
301. E. alopecuroides (L.) Ell. Silver plumegrass. Rocky open woods.
302. E. brevibarbis Michx. Openings and roadsides. Southern Arkansas.
303. E. coarctatus var. elliottianus Fernald.
304. E. giganteus (Walt.) Muhl. Giant plumegrass. Along roads and railways.

Arthraxon Beauv.

305. A. hispidus var. cryptatherus (Hack.) Honda. Ditches, scattered.

Andropogon L. Beardgrass; Bluestem

306. A. scoparius Michx. Little Bluestem. General.
307. A. divergens (Hack.) Anderss. ex Hitchc. Ashley and Hempstead.
308. A. gerardi Vitman. Big Bluestem. Open areas, general.
309. A. ternarius Michx. Scattered.
310. A. virginicus L. Broomsedge. Common in poor soils.
311. A. glomeratus (Walt.) B.S.P. Bushy beardgrass. Wet areas, south Arkansas.

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312. A. elliottii Chapm. Elliott beardgrass. Scattered.
 313. A. saccharoides Swartz. Silver beardgrass. Scattered.
 314. A. ischaemum L. Yellow bluestem. Escaped in Cleburne County.

Sorghum Moench

315. S. halapense (L.) Pers. Johnson Grass. Common.
 316. S. sudanense (Piper) Stapf. Sudan Grass. Occasionally escaped.
 317. S. vulgare Pers. Sorghum. Occasionally escaped.

Sorghastrum Nash.

318. S. nutans (L.) Nash. Indian Grass. Common in open areas.
 319. S. elliottii (Mohr.) Nash. Hempstead, Jefferson, and Washington.

Manisurus L. Jointtail

320. M. cylindrica (Michx.) Kuntze. Carolina jointtail. Scattered.
 321. M. rugosa (Nutt.) Kuntz. Wet pine woods, south Arkansas.

Tribe 14. Tripsaceae

Tripsacum Gamagrass

322. T. dactyloides (L.) L. Eastern Gamagrass. Widespread.

Addendum:

323. Muhlenbergia sobolifera (Muhl.) Trin. Northern Arkansas.

SUMMARY

The present list of Arkansas grasses includes a total of 322 different kinds of grasses, representing 80 genera, 306 species, and 16 varieties, compared with the 1941 list of 279 species and varieties. Branner & Coville(1) had listed 130 species and 3 varieties.

Further study will undoubtedly disclose many others in various parts of the state, and some may be found to be of much more value than some now in agricultural use.

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THE MEASUREMENTS OF AN AGED BOX TURTLE

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A female box turtle, Terepene carolina triunguis (Agassiz), bearing the inscription "HPF" on the left second lateral lamina of the carapace and "1923" on the right one was found at Fayetteville, Arkansas, on September 5, 1959. The authenticity of the inscription was confirmed by Hubert P. Finger (*in litt.*) who carved it on the carapace in the spring of 1923 when his family occupied the farm where the specimen was collected. Thus, when it was found there again recently, the turtle was at least 36 years old. The carapace laminae were smooth on recapture having lost all signs of annuli, the indications of yearly growth, and the base of the inscribed "3" contacted the seam between the second and third right lateral laminae of the carapace, suggesting there had been little or no growth subsequent to the time of marking (Ewing, Copeia, 1939, pp. 87-92). (This latter area was not distorted in outline as might occur due to cutting, showing that the lack of subsequent growth was not abnormal.) If the estimate made by Nichols (Copeia, 1939, pp. 14-20) that a box turtle reaches full growth at about 20 years of age applies to this species in Arkansas, the specimen probably was at least 20 years old when marked, or a total of some 56 years when found anew. Because the turtle could have attained its maximum growth some years prior to being marked, it might have been considerably older than 56 years.

Several box turtles have been reported that were marked and recovered over a span greater than 36 years, or even greater than the possible minimum age of 56 years (Deck, 1927, Copeia, no. 159, p. 160; Nichols, Copeia, 1939, pp. 14-20; Edney and Allen, Copeia, 1951, p. 312; Pope, 1946, Turtles, A. A. Knopf, N.Y., p. 118; Price, Copeia, 1951, p. 312), but few have been measured and none have been measured in detail. Because most of these aged specimens were released again the measurements are not obtainable. In the belief that such measurements might be useful to age-growth studies of this species the present specimen was measured in detail before being photographed and released. In view of the uncertainties pertaining to the appraisal of the turtle's real age these measurements might best be considered simply as pertaining to a box turtle which had reached a termination in its growth. The terminology used follows Carr (1952, Handbook of Turtles,

THE MEASUREMENTS OF AN AGED BOX TURTLE

Cornell University Press, Ithaca, N.Y.), the measurements are expressed in millimeters and were made with dividers unless indicated otherwise.

The overall dimensions were obtained with dividers (first value) for the linear distance from point to point, and with a flexible rule (second value) for the surface measurement: carapace length (from the depth of the anterior indentation), 122, 152; maximum carapace width, 96, 179; plastron length, 128, 142 (all plastron lengths are maximum values and not the distances from the depths of the anterior and/or posterior notches); pre-hinge plastron length, 53, 58; post-hinge plastron length, 78, 82; maximum pre-hinge plastron width, 67, 69; maximum post-hinge plastron width, 78, 81; maximum height of shell, 74, 97.

In the following laminae of the carapace the first value is the maximum anterior-posterior dimension, the second is the maximum medial-lateral or dorsal-ventral dimension: precentral, 5, 4, (partially destroyed); first central, 27, 27; second central, 28, 34; third central, 27, 40; fourth central, 29, 36; fifth central, 24, 32; left side -- first lateral, 38, 46; second lateral, 30, 53; third lateral, 29, 47; fourth lateral, 27, 35; right side -- first lateral, 36, 46; second lateral, 29, 54; third lateral, 30, 49; fourth lateral, 28, 35.

The first value of the measurements of the marginal and postcentral laminae is the length at the marginal ridge of the carapace, the second value is the maximum width from the inner seam to the marginal ridge: left side -- first marginal, 17, 10 (partially destroyed); second, 14, 11 (medial and lateral seams obscure); third, 12, 10; fourth, 14, 10; fifth, 15, 13; sixth, 16, 13; seventh, 19, 16 (posterior seam obscure); eighth, 20, 12 (posterior and anterior seams obscure); ninth, 16, 14 (anterior seam obscure); tenth, 15, 14; eleventh, 15, 14 (margin eroded); postcentral, 13, 10; right side -- first marginal, 13, 11 (partially destroyed); second, 11, 5 (margin eroded); third, 14, 10 (margin eroded anteriorly); fourth, 15, 10; fifth, 16, 13; sixth, 16, 13; seventh, 20, 15; eighth, 22, 11 (posterior seam obscure); ninth, 15, 15 (both seams obscure); tenth, 15, 14 (both seams obscure); eleventh, 13, 12 (both seams obscure and margin eroded); postcentral, 12, 9 (lateral and dorsal seams obscure). It is evident from the eroded indentations and obscured seams in the anterior and posterior regions of the marginal laminae that some past injury had been inflicted in these areas. Further indications of this were produced by scattered slight blemishes on the upper parts of the carapace.

The first value for each lamina of the plastron is the maximum anterior-posterior dimension, the second value is the maximum medial-lateral dimension: left side -- gular, 28, 15; humeral, 32, 33; pectoral, 22, 34; abdominal, 28, 38; femoral, 42, 40; anal, 40, 32; right side -- gular, 29, 16; humeral, 32, 34; pectoral, 22, 34; abdominal, 27, 38; femoral, 42, 40; anal, 42, 29.

The length of the seams between laminae were determined with dividers by measuring the straight-line distance between the two ends of the seam concerned: carapace seam between the first central and adjacent marginal laminae, 25; between the first and second central, 22; second and third central, 29; third-fourth central, 29; fourth-fifth central, 15; fifth central-postcentrals, 32; left side -- seam common to the first central and adjacent lateral lamina, 23; between the second central and two adjacent lateral laminae, 29; third central-lateral, 26; fourth central-lateral, 28; fifth central-lateral, 18; right side -- first central-lateral, 24; second central-lateral, 27; third central-lateral, 27; fourth central-lateral, 29; fifth central-lateral, 17. Left side -- junction of the first and second lateral laminae, 46; second-third lateral, 46; third-fourth lateral, 41; right side -- first-second lateral, 46; second-third lateral, 48; third-fourth lateral, 41.

The plastron seam between the bilateral gular laminae, 28; between the two humeral laminae, 8; the two pectorals, 17; abdominals, 27; femorals, 10; anals, 40. On the left side -- the gular-humeral seam, 28; humeral-pectoral, 34; pectoral-abdominal, 31; abdominal-femoral, 38; femoral-anal, 37; right side -- gular-humeral, 29; humeral-pectoral, 34; pectoral-abdominal, 32; abdominal-femoral, 37; femoral-anal, 38.

The distance from the tip of the tail to the anal aperture was 11 mm.

The eye color matched Plate 7, L-10 in the color dictionary of Maerz and Rand (1930, *A Dictionary of Color*, McGraw-Hill, N.Y.). This color is described as Kettledrum or Manzanita or Moro Red +.

The soft parts of the turtle appeared to be too bulky for the shell which prevented the simultaneous closing of both the anterior and posterior lobes of the plastron. The turtle first was weighed three days after capture and totaled 419 grams. Three days later it weighed 408 grams, and in still another three days 400 grams. Considering this rate of decrease, it could have weighed about 429 grams at capture.

SOME ASPECTS OF GEOLOGY AS A SERVICE TO THE PUBLIC

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The Geology Department of the University of Arkansas performs a little known, rarely publicized service to the public. This service consists of (a) the identification of rocks, minerals, fossils, and man-made substances sent to the Department and (b) the distribution of boxes of rock samples from Arkansas to primary and secondary school students working on earth science projects. The boxes are prepared by members of the local chapter, Alpha Psi, of Sigma Gamma Epsilon, an honorary scientific society devoted to earth science. About two dozen boxes are requested annually by students from all sections of the United States and are provided free of charge.

During the two-year period, 1958-60, the writer examined samples of rocks, minerals, and man-made substances submitted by 23 Arkansas residents. There were nine rock samples which included varieties of carbonate rock, shale, siltstone, and sandstone. Twenty-six mineral samples were submitted representing 16 mineral species which included: calcite, chalcopyrite, dolomite, galena, garnet, goethite, hematite, hemimorphite, limonite, marcasite, psilomelane, pyrite, quartz (including chert), selenite, smithsonite, and sphalerite. Man-made substances included fragments of bottle glass and furnace products of silicate, carbide, or metal alloy composition.

Two of the samples merit special consideration because of their unusual character and the length of time required to establish their identity and origin. One of the samples consists of alluvial material collected from deposits along the Saline River near Poyen, Arkansas. The other sample, a curious white ball, was discovered in the vicinity of Searcy, Arkansas.

The sender of the alluvial sample reported that it was collected from roadbase material used in the construction of a lumber road along the Saline River. The sender wished to learn why the alluvium never produced ruts in the road during and after rainfall.

The distribution of mineral and rock fragments in the alluvium presumably is responsible for the inability to form ruts after soaking, and a routine size analysis therefore was made on the sample by means of graduated sieves. The weighed sieve fractions (Table I) produced a nearly linear cumulative curve (Fig. 1, Curve I). Subsequent binocular examination of each of the 14 sieve fractions revealed that a portion of every

fraction was composed of small, round, cohesive aggregates of particles. Each particle must have been smaller than the sieve opening which retained the fraction. One type of aggregate consisted of small particles attached to a larger grain or grains. These grains ranged from sand through pebble sizes. Another type of aggregate consisted of uniformly small particles without a nucleus of larger grains.

In order to obtain an accurate measure of size distribution, disaggregation of the sample was necessary. N/67 sodium oxalate was employed as the disaggregating agent (1). The silt-clay portion of the treated sample was separated from the coarser material by means of settling velocities based on the application of Stoke's formula (4). The coarser portion of the sample was dried and resieved. The cumulative curve (Fig. 1, Curve II) representing the weighed fractions of the entire disaggregated or treated sample is markedly displaced from the untreated sample (Fig. 1, Curve I) and is also rather linear.

The sieve analyses of the sample before and after disaggregation are presented in Tables I and II. Table IV indicates the extent of weight loss from each fraction after disaggregation, except in the silt-clay fractions (<0.062 mm) where a striking weight gain is recorded. This gain can be explained only by the addition of the small disaggregated particles. In all fractions coarser than silt, the aggregated portion of each must have been composed of silt-clay particles. Figure 2 is a graphic plot of the degree of aggregation, expressed as a ratio, against the sieve opening for each fraction. In general, the sand sizes show a higher degree of aggregation than do other sizes.

A comparison of statistical parameters for the frequency distribution of particle sizes in the untreated sample and the same sample after disaggregation (Curves I and II respectively of Fig. 1) indicates the effect of aggregation on the alluvial material. The calculated frequency distributions, based upon quartile measurements, are presented in Table III. One aspect of aggregation is indicated by an apparent median size 17 times larger than the median size of the treated alluvium. Another aspect of aggregation is manifest in an apparent 2-fold increase in the sorting index of the treated sample over the untreated sample. In other words, aggregation of the silt-clay particles makes the alluvium appear to be better sorted than it is in reality.

Consideration of the weight percentages of the sample show it is composed of subequal amounts of sand, silt, and clay. One-tenth of the sample, approximately, is represented by granule-pebble sizes. Such a broad size distribution coupled

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TABLE I

SIEVE ANALYSIS OF THE INITIAL UNTREATED SAMPLE

<u>Sieve opening in mm.</u>	<u>Wt. in gm.</u>	<u>Wt. percent</u>	<u>Cumulative wt. percent</u>
3.36	50.20	19.02	19.02
2.38	15.52	5.90	24.92
1.68	12.90	4.91	29.83
1.19	15.59	5.92	35.75
.84	13.39	5.08	40.83
.59	17.02	6.46	47.29
.42	17.15	6.51	53.80
.297	16.91	6.42	60.22
.21	14.47	5.49	65.71
.15	13.18	5.01	70.72
.105	11.14	4.23	74.95
.062	17.42	6.62	81.57
< .062	<u>48.96</u>	<u>18.43</u>	100.00
	263.85	100.00	

TABLE II

SIEVE ANALYSIS OF THE DISAGGREGATED SAMPLE

<u>Sieve opening in mm.</u>	<u>Wt. in gm.</u>	<u>Wt. percent</u>	<u>Cumulative wt. percent</u>
3.36	29.66	11.48	11.48
2.38	7.21	2.79	14.27
1.68	5.18	2.00	16.27
1.19	5.18	2.00	18.27
.84	4.23	1.64	19.91
.59	5.61	2.17	22.08
.42	9.30	3.60	25.68
.297	10.38	4.02	29.70
.21	9.25	3.58	33.28
.15	9.35	3.62	36.90
.105	9.13	3.53	40.43
.062	8.73	3.38	43.81
.004	75.46	29.17	72.98
< .004	<u>69.80</u>	<u>27.02</u>	100.00
	258.47	100.00	

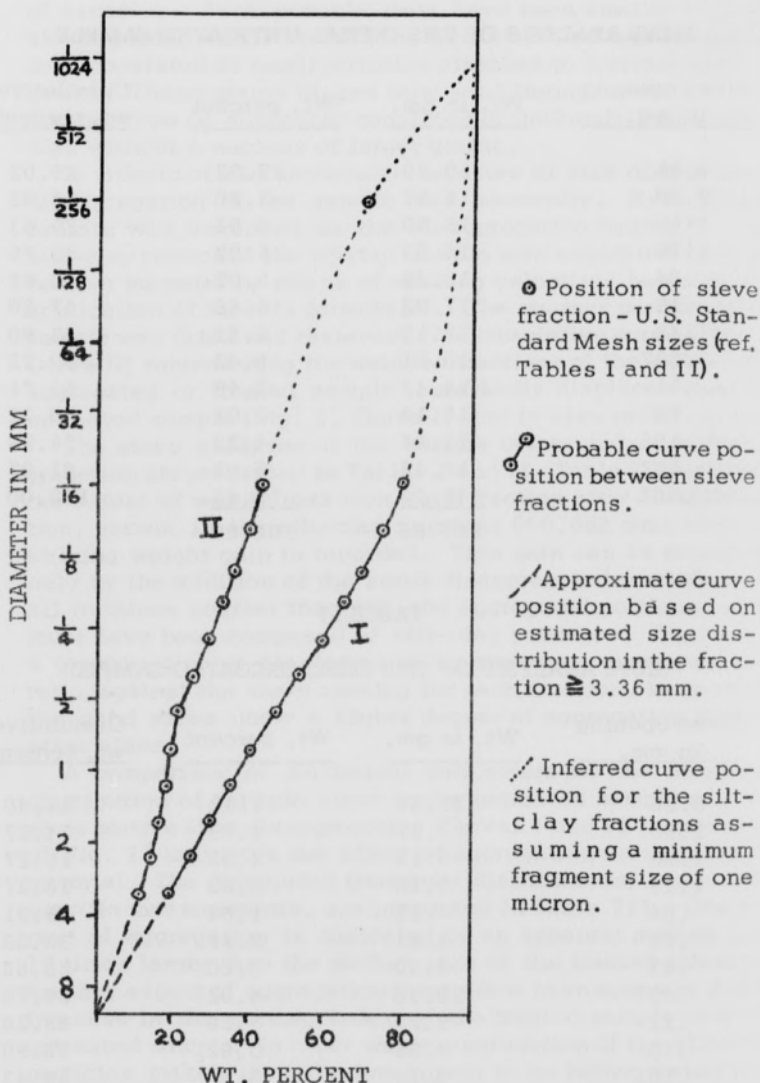


Figure 1. Cumulative Curves of the original (I) and the disaggregated (II) alluvial sample from the Saline River near Poyen, Arkansas.

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TABLE III

Parameter	Name	Calc. Value for Curves	
		I	II
Aver. size	Median	0.5 mm	0.03 mm
Sorting	Coeff. of sorting	4.75	10.72
Symmetry	Skewness	1.00	2.00
	($\log_{10} Sk$)	0	0.30
Peakedness	Kurtosis	0.38	0.06

with the relatively small amount of clay (ref. Table II) can account for the lack of cohesiveness in the alluvium after wetting and, therefore, for its ability to form ruts.

If the sample is representative of the Saline River alluvium near Poyen, Arkansas, then why does the alluvium contain aggregated particles? In lieu of actual geological reconnaissance of the area, a possible reason is suggested by the composition of the river water. One analysis* available to the writer is as follows:

<u>Component</u>	<u>mg/liter</u>
Dissolved solids	90
Chloride	3
Hardness	54
Alkalinity	135

The alkalinity value shown by the analysis suggests an alkaline water (L. E. Porter, personal communication) and a possible tendency toward flocculation, especially with respect to calcium salts (3). Silts and most insoluble particles of less than 20 microns diameter (except for clay minerals), are flocculated most readily by calcium salts in water whose pH

*John M. Little, collector and analyst. The water sample was taken about 15 miles upstream from Poyen, near Benton, Arkansas.

is at or close to 7(1). Such a chemical environment could be aggregation of silt-clay particles as was observed in the untreated sample.

TABLE IV

<u>Sieve opening in mm</u>	<u>Wt. loss (-) or gain () in gm</u>	<u>Aggregation Ratio*</u>
3.36	- 20.54	1/2.4
2.38	- 8.31	1/1.9
1.68	- 7.72	1/1.7
1.19	- 10.41	1/1.5
.84	- 9.16	1/1.5
.59	- 11.41	1/1.5
.42	- 7.85	1/2.2
.297	- 6.53	1/2.6
.21	- 5.22	1/2.8
.15	- 3.83	1/3.4
.105	- 2.01	1/5.5
.062	- 8.69	1/2.0
< .062	+ 96.30	1/0.5

* The ratio of the weight of the disaggregated portion, expressed as unity, to the weight of the untreated sample.

The curious white ball from Searcy, Arkansas, allegedly was discovered in a large rock, implying therefore that it is a naturally occurring substance. Laboratory studies of the ball, however, offer conclusive evidence that it is artificial or man-made in origin. Consider the following facts:

1. Dimensions of the ball in mm: 24.1 x 22.3 x 22.2
2. Habit: spherical, with spherical laminations, and peppered with tiny bubbles.
3. Color: snow white
4. Weight in gm of the ball: 29.15
5. Specific gravity: 3.65
6. Hardness (Moh's scale): 9
7. Wadell sphericity index: 0.95

These facts rule out the more common minerals. The surface of the ball is rather smooth and irregularly abraded. Certain artificial substances might fit this description.

Petrographic examination of ground fragments from the ball

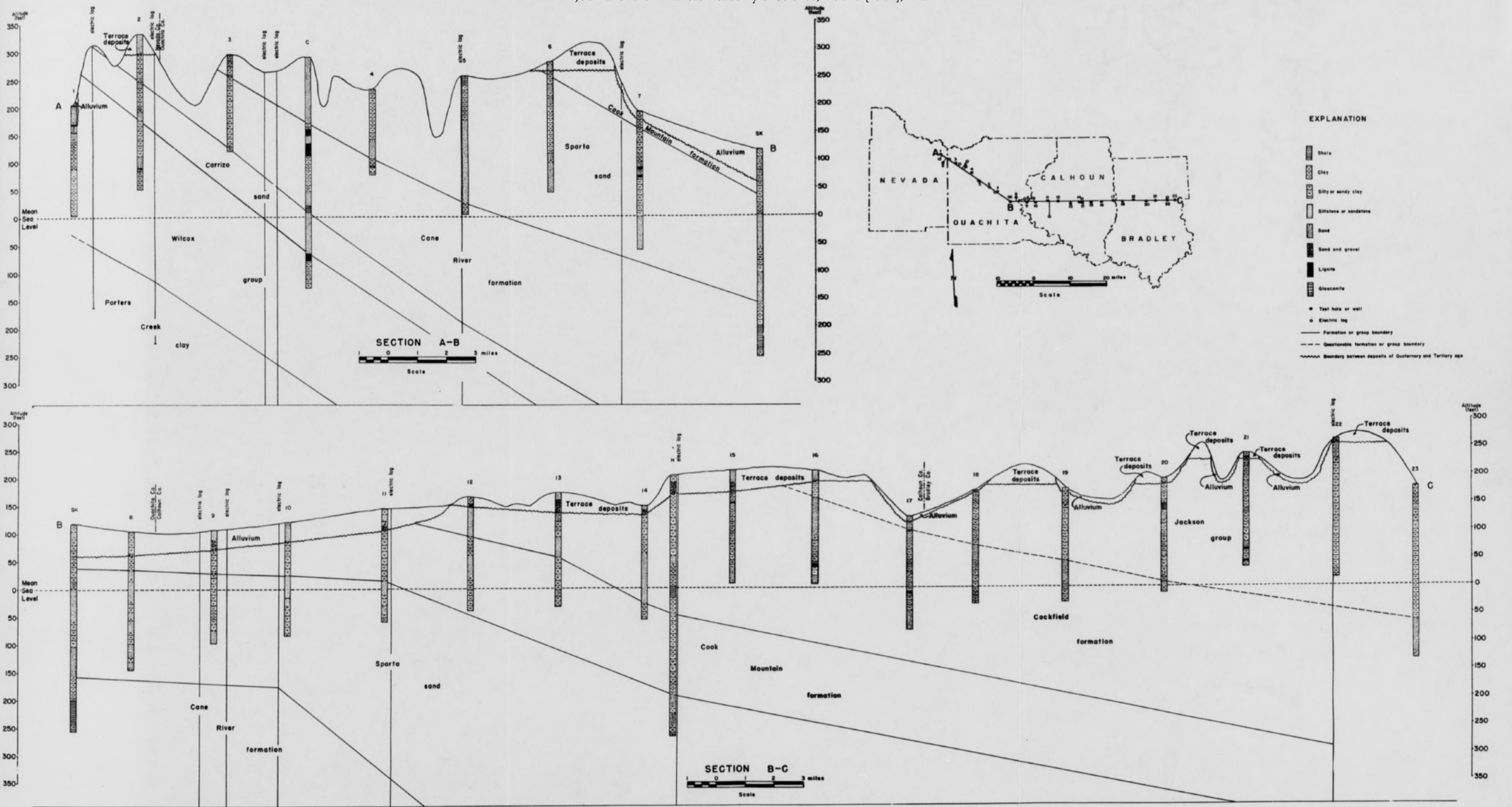


Figure 2.—Geologic sections from Nevada to Bradley Counties, Arkansas.

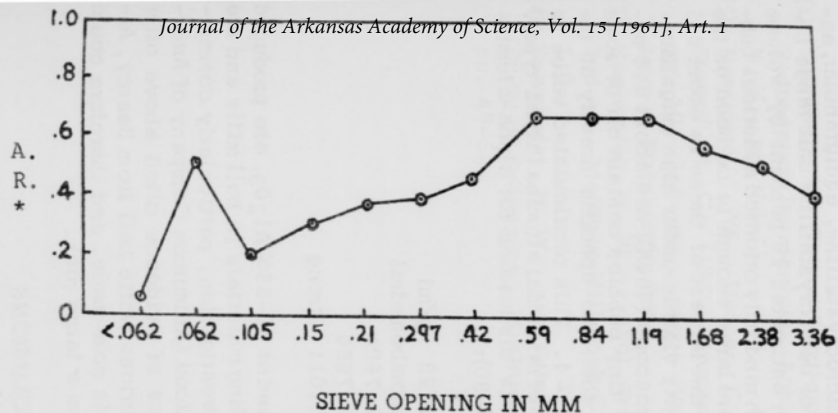


Figure 2. Graphic plot of the degree of aggregation of the sieved fractions from the sample of Saline River alluvium.

* A.R. The aggregation ratio of Table IV plotted as a decimal fraction. Increasing decimal values are proportional to the degree of aggregation.

provided some additional data:

1. Birefringence: low, first order gray to white
2. Uniaxial negative
3. Epsilon: slightly less than 1.76
4. Omega: slightly greater than 1.76
5. Dispersion: strong

The fragments appear as a microcrystalline, equigranular, anhedral mosaic. Dimensions of each crystalline unit range between 0.17 and 0.7 mm. An estimated 10 percent by volume of each unit is peppered with randomly oriented spherical bubbles. Many of the bubbles are large enough to be seen on the ball without magnification; the largest of these is about 0.5 mm in diameter. The smallest, visible under high magnification of the petrographic microscope (450X), are about 1.8 microns in diameter. If these tiny bubbles contain air or some gas of comparable density, then the specific gravity of the ball can be recalculated to ± 4 . This recalculated value is similar to the specific gravity of artificial alumina (alpha type).

Some data pertinent to this discussion for alpha-alumina is as follows (2, pp. 10, 29-30):

1. Density	3.98 g/ml
2. Crystallography	rhombohedral
3. Epsilon	1.7604
4. Omega	1.7686
5. Dispersion	0.011 strong

Alpha-alumina balls, composed of 80-95% Al_2O_3 , are produced for use as high density grinding materials in ball mills and are similar to the ball under investigation, particularly commercial type, T-164, made by Alcoa (Aluminum Company of America). The comparative lines of evidence cited above offer strong assurance that the curious white ball from Searcy, Arkansas, is an alumina ball, is man-made, and therefore could not have been recovered from a large rock.

CONCLUSIONS

Although the majority of rocks and minerals sent to the Geology department are readily identifiable, some are not and require additional study. This is especially true of man-made substances. Two examples, a natural alluvium and a man-made alumina ball, were presented herein to show a few of the various methods of study employed in the identification of some

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problematical substances. A necessary consideration given to all peculiar looking substances must be a decision as to a natural or a man-made origin. Such a rudimentary decision can avoid unnecessary delay and misleading interpretations in the ultimate identification processes.

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GEOLOGIC SECTION OF BRADLEY, CALHOUN, OUACHITA, AND PART OF NEVADA COUNTIES, ARKANSAS¹

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ABSTRACT

A series of 23 test holes has been drilled across Bradley, Calhoun, Ouachita, and part of Nevada Counties in south-central Arkansas to determine the geology of the shallow water-bearing deposits of Tertiary and Quaternary age. The correlation of the lithologic and electric logs of the test holes and available electric and drillers' logs of oil-test wells indicates that: (1) the transition zone in the upper part of the Midway group may be about 85 feet thick in Nevada and Ouachita Counties; (2) the contact between the Wilcox and Claiborne groups is about 12 miles northwest of the location shown on the geologic map of Arkansas, and the Wilcox group is probably not present at the surface anywhere in Ouachita County; (3) a structural terrace extends from near the boundary between Ouachita and Calhoun Counties into western Calhoun County; and (4) the Jackson group may extend in the subsurface as far west as Calhoun County and may be considerably thicker in Bradley County than has been previously supposed.

The deposits of Eocene age in the report area are composed mainly of sand, silt, and clay that were deposited near the shoreline of the Mississippi trough. The presence of lignite, glauconite, and marine microfossils suggests that the formations of this age were deposited under both subaerial and submarine conditions. The deposits of Quaternary age consist of coarse terrace sand and gravel and alluvium that generally is composed of finer sand, silt, and clay.

INTRODUCTION

The U.S. Geological Survey in cooperation with the Arkansas Geological and Conservation Commission is conducting a study of the ground-water resources of the State of Arkansas. As a part of this study, 23 test holes were drilled by a contractor in Bradley, Calhoun, Ouachita, and a part of Nevada

¹Publication authorized by the Director, U.S. Geological Survey.

GEOLOGIC SECTION OF COUNTIES IN ARKANSAS

Counties in south-central Arkansas in December 1958 and January 1959. The location of these counties within the State and the major structural and topographic features discussed in this report are shown in Figure 1. The primary purpose of the work was to determine the geological framework of the area and to obtain detailed information about the shallow water-bearing deposits of Tertiary and Quaternary age.

Electric logs were run on all test holes. The electric logs and the lithologic logs of the test holes and logs of three water-supply wells have been correlated with electric and drillers' logs of oil-test wells in establishing the formational boundaries. The logs of two of these water-supply wells are drillers' logs -- one of the city well at Hampton in Calhoun County, and the other of a well at the Southern Kraft Division of the International Paper Company at Camden, in Ouachita County. The third is a composite log of two test holes drilled in obtaining a water supply at Chidester in Ouachita County.

GENERAL GEOLOGY

The boundary between the Mississippi embayment part of the Coastal Plain and the Interior Highlands province (Cushing, and others, 1960) is known as the Fall Line (Fig. 1). In Arkansas this line follows a broad arc from the northeast corner to the southwest corner of the State. The rocks of tertiary age in Bradley, Calhoun, Ouachita, and Nevada Counties were deposited in the shallow Mississippi trough southeast of the Fall Line. Throughout the Tertiary period, the shoreline in the embayment fluctuated rather rapidly, providing an alternating sequence of submarine and subaerial environments of deposition. Consequently, the formations are composed of deposits ranging from fairly deep water clay and marl, through shallow-water sand, silt, and clay, to clean beach sand and lignitic back-beach silt and clay. The formations that are present in the report area are listed in Table 1.

The rocks of Tertiary age in Nevada and Ouachita Counties dip southeasterly away from the Fall Line at approximately 35 feet per mile. Near the Ouachita-Calhoun County line the dip changes to an easterly direction and decreases to about 2 feet per mile, forming a structural terrace. The terrace ends in western Calhoun County where the dip increases to about 20 feet per mile. This rate of dip remains fairly constant through the remainder of the report area; however, the direction of dip changes to the northeast in Bradley County reflecting the structural depression of the Desha basin.

Along most of its length, the section shown in Figure 2 was

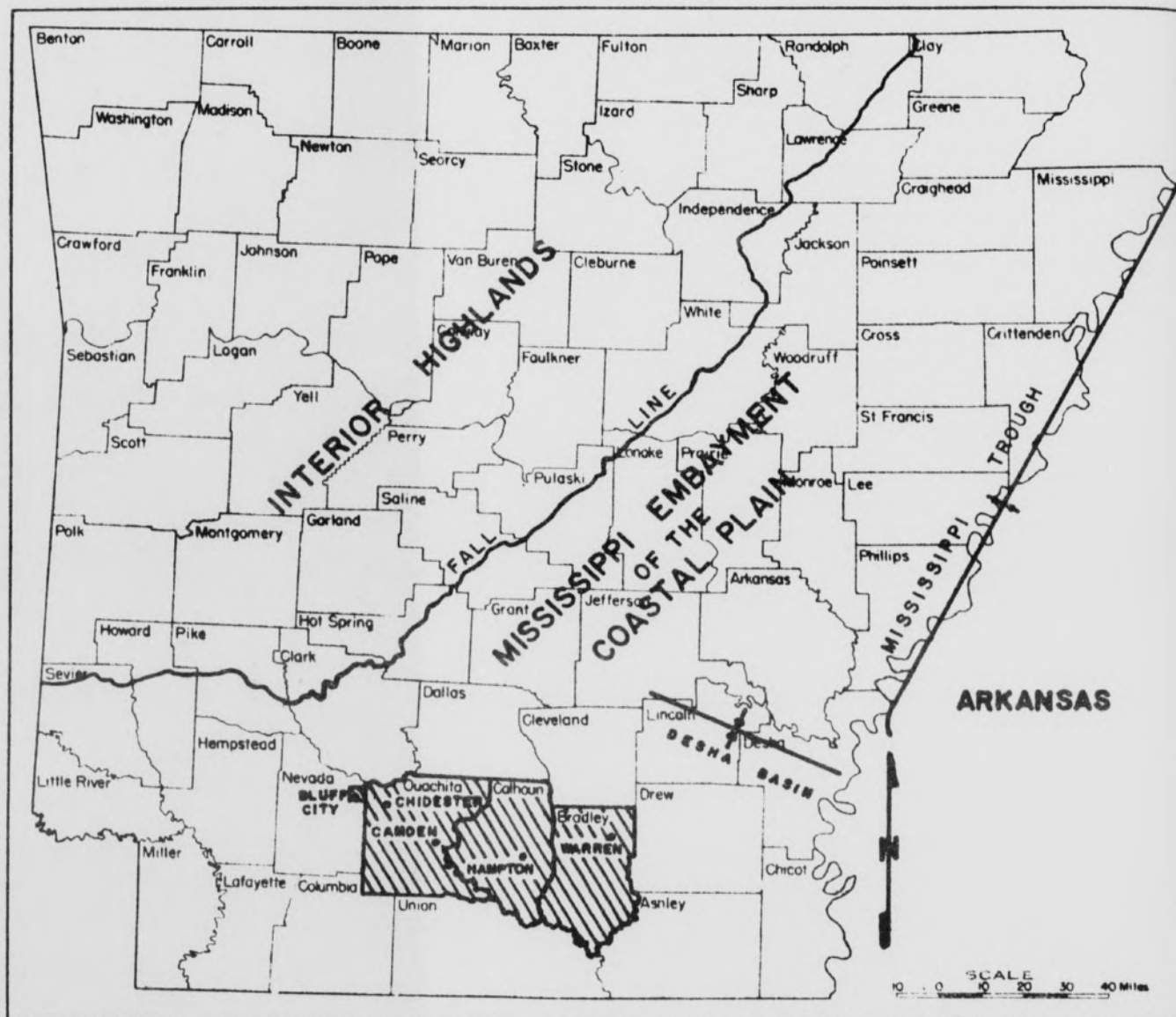


Figure 1. Map showing area and major topographic and structural features discussed in this report.

Table 1. Generalized geologic column of Bradley, Calhoun, Ouachita, and Nevada Counties, Arkansas

SYSTEM	SERIES	GROUP	SUBDIVISION
Quaternary	Recent		Alluvium
	Pleistocene		--- ? --- ? --- Terrace Deposits
Tertiary	Eocene	Jackson	
		Claiborne	Cockfield formation
			Cook Mountain formation
			Sparta sand
			Cane River formation
			Carrizo sand
		Wilcox	
	Paleocene	Midway	Porters Creek clay
			Clayton formation

drilled at right angles to the strike of the formations. The change in direction of the section line from southeast to east near Camden follows the change in direction of dip in that vicinity. Although the direction of dip changes again in eastern Bradley County, the last four test holes were drilled on the extension of the line in Calhoun and western Bradley Counties.

Midway Group

The Midway group of Paleocene age underlies most of the Mississippi embayment and crops out in Arkansas near the

Fall Line. In the area discussed in this report, the deposits vary in thickness from approximately 400 feet near the Fall Line to about 600 feet in Bradley County.

In Bradley, Calhoun, and Ouachita Counties, as in most of the Coastal Plain part of Arkansas, the Porters Creek clay of the Midway group generally is considered the fresh-water "basement," and once this formation is reached, further drilling in search of potable water usually is unprofitable.

In most of the previous geological work in Arkansas, the base of the first "sand kick" above the typical Porters Creek clay has been used as the formation top to facilitate making electric-log correlations. A sandy transition zone has been recognized above the clay, and it has been included in the Midway group by some authors, but placed in the Wilcox group by others. Correlation of electric logs in the vicinity indicates that the top of the typical Porters Creek clay, or the base of the transition zone, is about 35 feet below the total depth reached in test hole 1. A weathered zone of light-gray to white clay was encountered at a depth of 151 feet in test hole 1. This clay was underlain by a dark-gray to black clay, and it is thought that the top of this light-colored interval may mark the top of the transition zone and be the contact between the Midway group and the overlying Wilcox group. Because the test hole was stopped short of total penetration of the transition zone, which is about 85 feet thick at this location, the common electric-log pick of the top of the Porters Creek clay is shown on the accompanying section, and the transition zone is included in the Wilcox group. The determination of the proper placement of this zone must await the collection of more paleontological data.

Wilcox Group

In south-central Arkansas the Wilcox group of early Eocene age is not divided into formations as it is in the bauxite-producing area in Pulaski and Saline Counties. Such division might be possible in the area after detailed study of the group, but it is not attempted here. Deposits of the Wilcox group are conformable on those of the underlying Midway group, but an unconformity exists between the Wilcox group and the overlying Claiborne group (Stearns, 1957, p. 1092). The Wilcox group crops out in Nevada County and around the edge of the Mississippi embayment except in those areas where it is overlain by younger deposits. It is approximately 210 feet thick in the area of this report if the top of the light-gray to white clay in test hole 1 is the basal contact. Considering the base

of the group to be the conventional electric-log pick, as is shown on the cross section, the group is about 290 feet thick.

The drill cuttings from the test holes indicate that the Wilcox group in Nevada and Ouachita Counties consists of swamp or back-beach lignitic clays and lignite, shallow-marine sands and clays, and fairly deep water glauconitic clays. The back-beach clays are dark gray to dark brown in color and contain much lignite. The shallow-marine clays generally are light gray to gray, and the deeper water glauconitic clays are green in color. The sands of the group are mostly very fine to fine in grain size and gray or brown in color. The strand line evidently moved rapidly over these counties during Wilcox time, because there is no indication of any widespread beach-sand deposits in the area comparable to the "1,400-foot" sand of the Wilcox group, familiar to well drillers in northeastern Arkansas.

The contact between the Wilcox and Claiborne groups crops out near Bluff City in Nevada County and has a general north-east-southwest trend. The geologic map of Arkansas shows this contact about midway between Chidester and Camden in Ouachita County. The interpretation based on this geologic section indicates that the Wilcox group has a much smaller outcrop area than is shown on the State geologic map. It probably does not appear at the surface anywhere in Ouachita County.

Claiborne Group

In south-central Arkansas the Claiborne group of middle Eocene age includes five formations. From oldest to youngest they are the Carrizo sand, the Cane River formation, the Sparta sand, the Cook Mountain formation, and the Cockfield formation. All of the formations in this group, whether deposited under subaerial or submarine conditions or both, are composed of near-shore deposits.

Carrizo sand. -- The Carrizo Sand is approximately 70 feet thick in Nevada and Ouachita Counties where it was penetrated by test hole 2 and well C. Correlation of electric logs of oil-test wells indicates that the formation thickens to about 150 feet farther downdip in Bradley County.

The formation consists mainly of gray and brown very fine to medium sand, and it is probably a transgressive beach deposit; however, some shallow-water clay was encountered in test hole 2 and some lignite in well C.

Cane River formation. -- The Cane River formation is about 125 feet thick in the vicinity of test hole 3; and, based on

electric log correlations, it thickens downward to about 400 feet in Bradley County. It probably was deposited under much the same environmental conditions as prevailed during deposition of the Wilcox group. During Cane River time, however, the strand line was perhaps a little more stable as most of the formation consists of shallow-water dark-gray to dark-brown silts and silty clays. Some fluctuation of the strand line did occur as is evidenced by (1) the presence of some lignite and lignitic clay, which probably indicates back-beach deposition; (2) the presence of some clean sand, which is probably a remnant of the beach itself; and (3) the presence of some glauconite in test hole 4, which may indicate relatively deeper water deposition.

Sparta sand. -- The Sparta sand is approximately 280 feet thick at its outcrop near test hole 6, but it thins to about 200 feet across the structural terrace near the Ouachita-Calhoun County line. Correlation of electric logs of oil-test wells indicates that east of the terrace the formation thickens again to about 260 feet in central Calhoun County and to about 500 feet in Bradley County.

The formation consists mainly of gray very fine to medium sands and brown and gray sandy clays. A layer of medium to very coarse sand was encountered at or near the base of the formation in well C and test holes 4 and 5. The formation probably was deposited as a beach sand by a transgressive sea, but the shallow-water clay and back-beach lignitic clay and lignite found in Ouachita and Calhoun Counties indicate that the shoreline fluctuated somewhat in that area.

Cook Mountain formation. -- Except for that area where it has been subjected to erosion, the Cook Mountain formation maintains a rather uniform thickness of about 140 feet in the section shown in this report. In most of the Mississippi embayment the formation consists of fairly deep water marine clays, but in this area the near-shore shallow-water dark-gray to dark-brown silty clays are prevalent. The formation contains some silt, sand, and lignitic clay that probably was deposited in a back-beach environment.

Cockfield formation. -- The Cockfield formation maintains an average thickness of about 250 feet in Bradley and Calhoun Counties. Like most of the formations of Eocene age, it appears to have been deposited during a time of rapid shoreline fluctuations, because it is composed of both back-beach and shallow-water deposits. It consists mainly of gray and brown very fine to fine sand and silt, and dark-gray, dark-brown, and green lignitic silty clay. Some of the sand lenses are nearly free of silt and are probably beach deposits; but most

of the formation apparently was deposited under subaerial conditions inasmuch as most of the sand, silt, and clay of the formation is lignitic and lignite commonly is present as thin interbeds. Some of the sand contains small amounts of glauconite which probably was concentrated along the beaches by wave action.

Jackson Group

The interpretation shown on Figure 2 indicates that the Jackson group is about 295 feet thick in Bradley County and is present beneath a cover of terrace and alluvial deposits of Quaternary age as far west as the eastern part of Calhoun County. This thickness and extent of the Jackson group is considerably greater than that proposed by Wilbert (1953, p. 64) and is suggested for the reasons discussed in the following paragraphs.

The Jackson group consists mainly of gray, brown, and green silty clay and some lignite and was deposited primarily under marine conditions. Its contact with the predominantly continental sands of the underlying Cockfield formation is placed at a definite break in lithology as shown on Figure 2. This position of the contact, determined by the interpretation of lithologic logs, correlates well with a projection of the contact indicated by the characteristic "kick" at the change in lithology on electric logs of oil-test wells east of Bradley County. Unfortunately, this "kick" is not on all electric logs in the area of study, because surface casing has been set through the Cockfield-Jackson contact zone in most oil tests in Bradley and Calhoun Counties.

The interpretation shown on Figure 2 is also suggested by a zone of globigerina that occurs in several test holes between 20 and 30 feet above the contact shown. The presence of these marine microfossils indicates that the base of the Jackson group probably is not significantly higher than it is shown on Figure 2.

Further paleontological data are necessary to substantiate the placing of the Cockfield-Jackson contact at the suggested break in lithology near the zone of marine microfossils. Until these data are available, the position of the contact at the horizon shown on Figure 2 must be considered tentative.

Terrace Deposits

Most of the hills in the report area are capped with terrace deposits of Quaternary age. The deposits average 35 to 40 feet in thickness and mainly consist of poorly sorted sand,

some clay, and gravel.

This investigation indicates that there are at least three distinct terraces. The oldest terrace, and the one highest in elevation, is found at an altitude of approximately 300 feet, capping the hills in western Ouachita County and in at least that part of northeastern Nevada County where the first two test holes were drilled. The next terrace caps hills approximately 250 feet in altitude from central Ouachita County to eastern Bradley County. The youngest terrace, and the lowest in elevation, is found at altitudes of approximately 200 feet from central Ouachita County to eastern Bradley County, but its principal development is in Calhoun County. Gravel has been mined from each of the terraces, but the lowest terrace has been most extensively exploited.

The various terraces have not been differentiated on the section. It should be possible to make a distinction between them after geologic mapping is completed and adequate elevation control is established.

Alluvium

Alluvium of Quaternary age covers a large part of southern Bradley and Calhoun Counties and fills most of the stream valleys in the report area. It averages 35 to 40 feet in thickness and mainly consists of sandy clay, poorly sorted sand, and gravel derived from the older terrace deposits. The alluvium is generally somewhat finer in overall grain size than the terrace deposits.

The contact between the alluvium and the terrace deposits can be only approximated on the section at this time. Some of the alluvium may be of Pleistocene age.

LITHOLOGIC LOGS

Lithologic logs of test holes 1 and 23 drilled for the accompanying section, the composite log of the city supply well at Chidester, and driller's logs of the city well at Hampton and a well at the Southern Kraft Division of the International Paper Company at Camden are given in Table 2. The stratigraphic designations shown on the driller's logs are the author's interpretation and are based on electric logs of nearby oil-test wells and the test holes drilled under contract for the U. S. Geological Survey.

Table 2. Lithologic Logs

Test hole 1

Location: Nevada County, SW1/4 NW1/4 SE1/4, sec. 27,
T. 11 S., R. 20 W.
Drilled by: H. E. Cutter and Dad Drilling Co.
Log by: U. S. Geological Survey
Surface altitude: 204 feet

	Thickness (feet)	Depth (feet)
Quaternary		
Alluvium		
Gravel, granules and pebbles	1	1
Sand, fine to medium, clayey, brown	4	5
Sand, very fine, clayey, variegated red, brown, orange, and gray; contains some very coarse sand, granules, and gray clay	10	15
Sand, very fine, silty and clayey, gray	5	20
Sand, very fine to medium, brown	5	25
Sand, very fine to medium, light-gray to white; contains some clay	5	30
Sand, very fine to very coarse, brown	4	34
Gravel, granules and pebbles, black; contains some wood fragments	2	36
Tertiary-Eocene		
Wilcox group		
Clay, dark-gray to dark-brown	13	49
Lignite	1	50
Clay, dark-gray to dark-brown; con- tains interbedded lignite	10	60
Clay, light-gray	5	65
Clay, silty, green to bluish-green, glauconitic	5	70
Clay, silty and sandy in part, light- gray to gray; contains some glau- conite and lignite	45	115

ARKANSAS ACADEMY OF SCIENCE

Table 2. Lithologic logs (continued)

Test hole 1 (continued)

	Thickness (feet)	Depth (feet)
Sand, very fine to fine, clayey, gray	10	125
Clay, silty, gray, lignitic in part	12	137
Clay, silty, brown to gray-brown; interval from 150-151 feet ap- pears weathered	14	151
Clay, light-gray to white	11	162
Clay, dark-gray, almost black; con- tains some interbedded light-gray to white clay, hard streaks of ce- mented sand at 183 feet, 193 feet, and 196 feet	38	200

Well C

Location: Ouachita County, NE 1/4 NE 1/4 NE 1/4, Sec. 14,
T. 12 S., R. 19 W.

Owner: Town of Chidester, Ark.

Drilled by: [Log from the surface to 178 feet is modified
from a driller's log supplied by the Carlross Well
Supply Co. Log from 178 feet to total depth is
from a test hole drilled by the Childers Drilling
Co. and logged by the U. S. Geological Sur-
vey.]

Surface altitude: 286 feet

	Thickness (feet)	Depth (feet)
Tertiary-Eocene		
Sparta sand		
Sand, reddish-brown	8	8
Sand, brown; contains streaks of red clay	12	20

Table 2. Lithologic logs (continued)

Well C (continued)

	Thickness (feet)	Depth (feet)
Sand, white to light-tan	10	30
Sand; contains streaks of soft white clay	21	51
Sand, light-brown to tan, water bearing	47	98
Sand, hard-packed, water-bearing; contains 5 feet of coarse sand	20	118
Cane River formation		
Clay, hard	7	125
Clay, sandy, soft	4	129
Clay, black, very hard [lignite]	12	141
Sand, streaks	4	145
Sand; contains streaks of clay	10	155
Clay, black, very hard [lignite]	22	177
Rock, hard	1	178
Clay, and lignite, dark-brown	63	241
Sand, medium, light-gray	13	254
Sand, medium, clayey, brown; contains lignite	12	266
Shale, brown	13	279
Carrizo sand		
Sand, fine to medium, gray; contains blue to almost black clay	26	305
Sand, very fine to medium, brown; contains streaks of shale, clay, and some gravel	24	329
Sandstone, fine-grained, brown	2	331
Sand, fine to medium, gray; contains streaks of brown siltstone and some lignite	22	353
Wilcox group		
Lignite	13	366

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Table 2. Lithologic logs (continued)

Well C (continued)

	Thickness (feet)	Depth (feet)
Clay, sandy, gray; lignite streak at 374 feet	28	394
Siltstone, brown	2	396
Clay, sandy, gray	19	415

Well SK

Location: Ouachita County, NW1/4 NW1/4 NE1/4, sec. 2,
T. 14 S., R. 17 W.
Owner: Southern Kraft Division, International Paper Co.
Drilled by: Layne-Arkansas Co.
Log by: Layne-Arkansas Co.
Surface elevation: 120 feet.

	Thickness (feet)	Depth (feet)
Quaternary		
Alluvium		
Clay	14	14
Sand	8	22
Sandy gumbo	10	32
Sand and gumbo	28	60
Tertiary-Eocene		
Cook Mountain formation		
Sandy clay	20	80

Table 2. Lithologic logs (continued)

Well SK (continued)

	Thickness (feet)	Depth (feet)
Sparta sand		
Sandy clay	37	117
Sand	58	175
Sandy clay	47	222
Sand	53	275
Cane River formation		
Soft gumbo	35	310
Rock	1	311
Gumbo, thin rock	1	312
Gumbo	5	317
Sandy shale	1	318
Shale and boulders	42	360
Sandy clay	15	375

Well H

Location: Calhoun County, NE 1/4 NE 1/4 NE 1/4, sec. 6,
T. 14 S., R. 13 W.
Owner: City of Hampton, Ark.
Drilled by: Layne-Arkansas Co.
Log by: Layne-Arkansas Co.
Surface altitude: 203 feet

	Thickness (feet)	Depth (feet)
Quaternary		
Terrace deposits		
Soil	12	12
Gravel	23	35

Table 2. Lithologic logs (continued)

Well H (continued)

	Thickness (feet)	Depth (feet)
Tertiary-Eocene		
Cockfield formation		
Clay	30	65
Soft rock	2	67
Gumbo and sandy shale	78	145
Fine sand	4	149
Sand and shale	6	155
Fine sand	5	160
Sandy shale	20	180
Fine sand	4	184
Gumbo	16	200
Shale	20	220
Gumbo	25	245
Gumbo and 3-inch rock	5	250
Rock	1	251
Cook Mountain formation		
Gumbo	3	254
Soft rock	1	255
Gummy shale	61	316
Hard gumbo	10	326
Shale and sand	6	332
Sandy clay	42	374
Gumbo	23	397
Sparta sand		
Fine-packed sand	19	416
Gumbo	13	429
Fine gray water sand	21.5	450.5
Sandy shale	20.5	471

Table 2. Lithologic logs (continued)

Test Hole 23

Location: Bradley County, SW 1/4 NE 1/4 NE 1/4, sec. 4,
 T. 14 S., R. 9 W.
 Drilled by: H. E. Cutter and Dad Drilling Co.
 Log by: U. S. Geological Survey
 Surface altitude: 178 feet

	Thickness (feet)	Depth (feet)
Tertiary-Eocene		
Jackson group		
Clay, silty and sandy, brown, red, and gray	10	10
Clay, silty, gray, buff, and brown, micaceous in part; contains some interbedded dark-brown silt	20	30
Clay, greenish-gray, lignitic; con- tains interbedded silt, some weathered streaks	5	35
Clay, silty, dark-gray, lignitic; contains interbedded silt and very fine sand	20	55
Clay, silty, dark-gray, greenish- gray, and dark-brown, lignitic; contains interbedded silt and lignite, hard streaks at 64 and 80 feet	25	80
Clay, green, lignitic, and lignitic dark-brown and greenish gray silty clay; contains interbedded lignite, silt, and very fine sand	160	240
Cockfield formation		
Sand, very fine to fine, and silt, gray; contains some interbedded clay and lignite	70	310

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MISSOURI: A SOUTHERN OR MIDWESTERN STATE?

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Centrally located in the United States, Missouri lies on the eastern edge of the Great Plains and on the southern edge of the glaciated area. Its landforms are a combination of plains and hills, and its soils are largely of the gray-brown podzolic and black earth varieties. Since Missouri is on a parallel with Illinois and Kansas, it has been grouped with the north-central states by geographers and the census bureau since at least 1870.

In many aspects, however, Missouri has been just as southern as midwestern in orientation. Missouri is tied to the South and the Midwest by its drainage system. The Missouri and Mississippi Rivers and their tributaries border and flow through the state of Missouri on their journey from the upper Midwest to the Gulf of Mexico. These rivers early linked Missouri to the Midwest and to the South through their transportation of people, furs, and commerce.¹

Because of a common drainage system, Missouri was explored and settled almost simultaneously by the same type of people as the upper South and the Middle West. Although Francisco Vasquez de Coronado probably did not reach Missouri in his exploration of the Southwest in 1540, Louis Joliet and Father Jacques Marquette did when they made their historic descent of the Mississippi River to the mouth of the Arkansas River in 1673. Joliet and Marquette especially noted the locations where the Missouri and Ohio rivers joined the "Father of Waters."²

Until 1763, the area of Missouri was under French control. At that time, the Louisiana Territory was transferred to Spain by the Treaty of Paris, which ended the Seven Years War. The main center of Spanish activity in the Louisiana Territory after 1763 was at St. Louis. In that year Pierre L. Liquest (Laclede) and his stepson, Auguste Chouteau, came up to the St. Louis region from New Orleans and established a trading

¹John H. Garland, ed., The North American Midwest: A Regional Geography (New York, 1955), 1-15.

²William B. Munro, Crusaders of New France (New Haven, Connecticut, 1918), 103; James C. Olson, History of Nebraska (Omaha, 1955), 29-32.

post. In 1767 a Spanish official made his appearance at St. Louis and two years later Alexander O'Reilly took over the leading role in the development of the upper Louisiana Territory for the Spanish. O'Reilly's Spanish-Missouri Fur Company began the exploration of Nebraska and the Dakotas.

Despite their activity, the Spanish had moved only a short distance out of St. Louis by 1785. After 1785 the Spanish began to travel the upper Missouri River more to protect their land and keep out the British and Americans, than to obtain trade. The attack against the Spanish hold in the West in the 1780's was led by England's Hudson Bay and Northwest companies. Swarming out of Mackinac and Prairie du Chien in the Lake Michigan area, the traders of these companies went as far west as the Mandan villages on the upper Missouri River. In 1791 Spain, fearing the loss of northern Louisiana, sent agents up to win back the Indians. Auguste Chouteau was dispatched to build Ft. Carondelet among the Osage villages in 1794. Both Jacques L'Eglise and Jacques Clamorgan made expeditions up the Missouri to the Mandan villages in the 1790's. Despite their efforts, Spanish influence in the Middle West remained weak. As late as 1803, the Chippewa and Sioux Indians in Minnesota and the Dakota's were under the control of the British trading companies.³

The American conquest and exploration of the western section of the Midwest did not take place until after 1803, when

³William F. Zornow, Kansas: A History of the Jayhawk State (Norman, Oklahoma, 1957), 27-35; Jonas Viles, A History of Missouri (New York, 1935), 13-21.

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the United States purchased Louisiana Territory from France.⁴ Almost immediately President Thomas Jefferson decided that he wanted to have this unknown region explored. He selected Meriwether Lewis and William Clark for the mission. In May of 1804, they set out from St. Louis with a party of 45 men and three boats. Ascending the Missouri River, they passed a few Creole and American villages in Missouri. They made their first Kansas landfall at the present site of Kansas City. As they proceeded up the Missouri, they saw large numbers of buffalo, elk, antelope, deer, coyotes, wolves, and wild turkeys. After leaving Missouri in 1804, they went to the Pacific coast via the upper Missouri, and then retraced their steps back to St. Louis.

A second famous American explorer in the area in this period was Lieutenant Zebulon M. Pike. In August 1805, Jefferson sent the twenty-six-year-old Pike with twenty men to find the headwaters of the Mississippi River. Although attaining some success in his negotiations with the Sioux, Chippewa, and the British, he failed in his primary mission. He mistook Leech Lake for the source of the Mississippi. Soon after returning to St. Louis in April 1806, Pike was sent west with a party of 23 men to make peace with the Pawnee Indians and to explore the country drained by the Arkansas and Red Rivers. Venturing too far south, however, he was captured by the Spanish, and subsequently released and returned to Louisiana in July 1807.

⁴Theodore Roosevelt stated in his Winning of the West that the United States would have acquired the Louisiana Territory even if President Thomas Jefferson had not purchased it. Roosevelt contended that the American frontiersmen swarming into the valleys of the Tennessee, the Cumberland, and the Ohio would have flowed on across the Mississippi to acquire the area by occupation. Be that as it may, the United States still obtained a bargain in buying the Louisiana area for \$15,000,000. By this purchase, the United States not only obtained unrestricted navigation of the Mississippi, but all or part of the future states of Arkansas, Colorado, Iowa, Kansas, Louisiana, Minnesota, Missouri, Montana, Nebraska, North Dakota, Oklahoma, South Dakota, and Wyoming. Theodore Roosevelt, The Winning of the West: An Account of the Exploration of Our Country from the Alleghanies to the Pacific (New York, 1906), VI, 99-125.

Later expeditions included Henry R. Schoolcraft's exploration into the Ozark Mountains of Missouri and Arkansas in 1818 and Colonel Henry Atkinson's "Yellowstone Expedition" in 1819. Atkinson's group went up the Missouri River to Council Bluffs where they built Ft. Atkinson to serve as winter quarters. The scientific portion of this expedition was commanded by Major Stephen H. Long, who helped to build up the tradition that the western Midwest was the "Great American Desert."⁵

Much of the exploration of the Louisiana Territory was also accomplished by the fur traders who traversed its rivers and streams. Among the first important American fur-trading companies in the Missouri River area was the Missouri Fur Company under the direction of Manuel Lisa. Beginning his trading activities with the Osage prior to 1800, he concentrated his operations at Ft. Lisa near Omaha in 1812, where he controlled the trade with the Omaha, Pawnee, and Oto. From 1812 to around 1823, the Missouri Fur Company was the most important trading company on the Missouri River.

The fur company, however, that did the most to tie the fur trade in the trans-Mississippi area together was the American Company established by John J. Astor in 1808. After 1820 Astor moved into the Missouri River area and quickly absorbed the competition, of which there was an abundance. In 1822 there were an estimated 1000 fur traders on the upper Missouri and 500 on the upper Mississippi. In June 1827, when Ft. Atkinson was abandoned and the Sixth Infantry transferred to Jefferson Barracks near St. Louis, Bellevue, a post a few miles south of Ft. Atkinson, became the center of the fur trade on the Missouri under the direction of the American Fur Company. But even the American Fur Company could not last forever. Liquor and cutthroat competition had taken their toll, and the beaver, mink, muskrat, otter, and fox were disappearing. The American Fur Company went broke in 1841, and by 1850 the romantic period of the beaver was drawing to a close.⁶

As early as 1732, a few French people from Illinois built cabins at a location that became Ste. Genevieve, Missouri. A large number of the early settlers in Missouri were relatives or descendants of the French in the southern Illinois villages.

⁵Ibid., VI, 155-94; Ray A. Billington, Westward Expansion: A History of the American Frontier (New York, 1949), 446-53.

⁶Olson, Nebraska, 42-46; Billington, Westward Expansion, 444-65.

In 1750 the St. Louis area was considered one of the four main French outposts and trading centers in the central United States. Forty families moved there in 1764. By 1772 there were 1,288 (803 white and 485 Negro) people in Missouri, of which nearly half were in St. Louis.

In the early 1770's, the Spanish opened up homesteads to Americans who crossed the Mississippi River into Missouri. An American could obtain 800 acres for \$40.00, the clerical and surveying costs. The Spanish did this for the purpose of setting up an American buffer against the English. The Americans were supposed to be Catholic and loyal to the Spanish king, but these provisions were not rigidly enforced. The leading Spanish villages in the Missouri country in the 1790's were St. Louis, Ste. Genevieve, New Madrid, St. Charles, Cape Girardeau, and La Charette.

After 1798 Americans poured in. Moses Austin came to St. Louis in 1799. He sank the first lead shaft and built a shot tower on a cliff at Herculaneum. Daniel Boone joined his sons at La Charette, Missouri, in 1799. On his arrival from Kentucky, Boone was given command of the district where he settled and a land grant of 8,500 acres on the Missouri River. Boone and his sons began making salt at Boone's Lick, and were soon supplying the residents of St. Louis with salt.

Missouri, along with Ohio, Illinois, Kentucky, and Indiana, also profited from the Ohio River migration that took place around 1800. Theoretically, Missouri had an advantage over the three states to the east in attracting settlers from the South. The Land Ordinance of 1785 and the provisions of the Ordinance of 1787 were both applied to Missouri, with one exception. The non-slavery clause did not apply to Missouri, because the United States had to accept the Spanish property law allowing slaves, which was in force when the U. S. purchased the Louisiana Territory in 1803. Thus a number of southerners did cross Indiana and Illinois into Missouri, because only the latter allowed slaves. Some Illinois residents referred to the Missourians as "Pukes," because they maintained that Illinois had regurgitated them.⁷

Indiana and Illinois also had a struggle over the slavery issue, but it came out differently in those states than in Missouri. Since Missouri did not have the non-slavery clause of the Ordinance of 1787 and since it had a larger influx of southerners with slaves, Missouri maintained slavery as an active institution during its territorial period and came into the Union

⁷Viles, Missouri, 22-40.

as a slave state under the famous Missouri compromise.

Settlement in Missouri up to 1815, however, was relatively slow. One reason for this was the fact that Missouri had a terrific land-title problem. Few people had received good titles from the Spanish government. It took a congressional commission some thirty years to get the titles straightened out. Land offices were not even opened to sell land in the area until 1818, and as a result Missouri had many squatters. This is one reason why Senator Thomas H. Benton took the western view on squatter and pre-emption laws.

The influx of settlers into Missouri in the period 1815 to 1819 was a part of the general westward movement in the period after the War of 1812. With this inpouring of settlers, Missouri's population expanded by leaps and bounds. From the low figure of 19,783 in 1810, Missouri's population grew to 66,586 by 1820. Seven-eighths of these people were farmers, and most of them lived in the Missouri River-Boonville-Franklin area. The slaves present were used as servants or in general farming; there were few staple crops or plantations.⁸

With the building of the Erie Canal, the main immigration route shifted from the Ohio River to the Great Lakes after 1825, and Missouri's settlement slowed down. Like the southern parts of Ohio, Indiana, and Illinois, the largest number of Missouri's residents, born-out-of-state, came from Kentucky, Tennessee, and Virginia. Despite the decline in the rapidity of settlement, Missouri's population still increased to 383,702 by 1840.

Like the states to the East, Missouri had a heavy influx of Germans in the two decades after 1840, especially in the St. Louis area. As early as 1850, 12 per cent of Missouri's population was from foreign countries of which about seven per cent or 44,352 were from Germany.⁹

⁸Ibid., 54-64.

⁹Carl Wittke, We Who Built America: The Saga of the Immigrant (New York, 1945), 202-03. Missouri, like her neighbors, served the function of populating states further west. Missouri, with the main western trails originating within her boundaries, became the "mother of states." Both the Oregon and California trails had their point of origin in Missouri; and Missourians also claimed the distinction of opening up the Santa Fe Trail. In 1850 Missouri did have the largest number of ex-residents in Oregon and California, and the seventh largest number in Texas. Viles, Missouri, 22-40.

After the Civil War, Missouri became a mixture of pure Anglo-Saxon stock in the Ozark Mountains, a large German element in St. Louis, and heterogeneous Americans. Out of Missouri's 216,379 foreign born in 1900, over half of them were German. Ireland and England contributed the next largest groups of foreign-born residents to Missouri.¹⁰

The territorial stage of Missouri at first paralleled the territorial developments in the midwestern states of Indiana and Illinois. Three months after its purchase in 1803, the newly acquired Louisiana Territory was divided by Congress at the thirty-third parallel. The enormous area north of this line was named the District of Louisiana and for a short period was attached to the Indiana Territory for administration. During this period, American institutions and laws were introduced into Missouri by Indiana's Governor William H. Harrison in a fifty-five page volume of statutes. But the attempt to govern St. Louis and the other Missouri settlements from Vincennes proved unsuccessful, and Congress in 1805 formed the Territory of Louisiana with its capital at St. Louis. In 1812 the name of Louisiana Territory was changed to Missouri Territory to avoid confusion with the newly admitted state of Louisiana. At the same time, Missouri went into the second territorial stage and was allowed to elect its own legislature. In 1819 Missouri's boundaries were drawn along their present lines. The area to the south became Arkansas Territory, and that to the west and north remained unorganized. The parallel of 36 degrees and 30 minutes was the southern boundary, with the exception of the New Madrid settlements in southeast Missouri. Two years later, Missouri was finally admitted as a slave state, having

¹⁰Abstract of the Twelfth Census of the United States 1900
(Washington, D. C., 1904), 42 and 60.

been paired off with Maine as a free state.¹¹

In the period prior to the Civil War, Missouri's political views were personified in the southerner Thomas H. Benton. Born in North Carolina, he moved to Tennessee, and then to Missouri in 1815. He served as the United States Senator from Missouri from 1821 to 1851. He lost his senate seat because he opposed the secessionists and favored the gradual abolition of slavery. His last official position was that of United States Representative from 1853 to 1855. He ran for governor of Missouri at the age of 74 in 1856, was defeated, and died of cancer two years later. One of the most outspoken and influential of the southern and western politicians, he advocated sound money, opposed the national bank, championed a liberal land policy, opposed the annexation of Texas, and favored a gradual abolition of slavery. He represented a compromise of the South and the West not only in the measures he advocated, but even in his manner of speech, which was earnest, assured, boastful, buoyant, and idealistic.¹²

After the Civil War, Senators Carl Schurz and Benjamin G. Brown of Missouri, both former Union brigadier generals, took the lead in forming the Liberal Republican Party. Tired of President Ulysses S. Grant's nepotism, corruption, inefficiency and harsh rule in the South, the Liberal Republicans held their national convention in Cincinnati in 1872 and adopted a platform of leniency toward the South, civil service reform, and a lower tariff. As a presidential candidate, they chose Horace Greeley, lifelong foe of the Democrats and a low tariff. With-

¹¹The Missouri Compromise was passed in 1820, but the actual admittance of Missouri to the Union was held up for another year due to a provision in Missouri's Constitution, which in effect barred free Negroes from the State. This brought on a new debate in Congress over whether or not this abridged the privileges and immunities of citizens as stated in the U. S. Constitution. This so-called second compromise provided that the President of the United States would proclaim Missouri a state if the Missouri legislature would promise not to pass a law abridging the privileges and immunities of citizens of other states. The Missouri legislature agreed to this arrangement, and Missouri was officially declared a state in August 1821.

¹²Thomas H. Benton, Thirty Years View 1820-1850 (New York, 1856), I, 1-125; Theodore Roosevelt, Thomas H. Benton (Boston, 1886), 43-63, 102-28, 281-325.

out enthusiastic Democratic support and opposed by the majority of the Republicans, Greeley was easily defeated. Missouri deserted the Midwest and joined the South in casting a majority of the Republicans, Greeley was easily defeated. Missouri deserted the Midwest and joined the South in casting a majority of its electoral votes for Greeley and Brown.¹³

In the period 1875 to 1899, Missouri's most noted congressman was Richard P. (Silver Dick) Bland. He was a spokesman for both the agrarian West and South in their advocacy of the free coinage of silver. He was co-author of the Bland-Allison Act of 1878, which provided that the treasury department would buy two to four million dollars of silver bullion each month for coinage.

In 1912 Missouri had a leading presidential contender in the form of Champ Clark, Speaker of the House of Representatives. Clark had a majority of the delegate votes on numerous ballots, but he could not obtain the two-thirds vote required for nomination. Although William J. Bryan and the Nebraska delegation were pledged to Clark, they finally deserted Clark for Woodrow Wilson when Tammany of New York swung to Clark. This resulted in Wilson obtaining the nomination on the forty-sixth ballot. Clark was very angry at Bryan over his defection.¹⁴

In more recent years, the southern and western quality of Missouri's politicians has been represented in President Harry S. Truman and Senator Stuart Symington. Truman obtained the nomination for vice president in 1944 when the political bosses pushed out the more liberal Henry A. Wallace. Several months after taking office for the fourth time, President Franklin D. Roosevelt died and the man from Missouri was left with the final World War II victory, the making of the peace, and the establishment of the United Nations.

After an eventful first term, President Truman ran for office again in 1948. His platform included stronger civil rights, federal health insurance, and federal aid to education. A southern block refused to go along with his civil rights plank and they nominated J. S. Thurmond on the Dixiecrat ticket. A progressive bloc opposed Truman's "get tough policy" with

¹³Howard P. Nash, Jr., Third Parties in American Politics (Washington, D. C., 1959), 106-20.

¹⁴James B. Clark, My Quarter Century of American Politics (New York, 1920), I, 323; David Lawrence, The True Story of Woodrow Wilson (New York, 1924), 51-54.

Russia and chose Henry A. Wallace as its candidate. But despite the fact that Truman's party was split, and the Midwest was divided in its support of him, Truman still won a substantial victory.

Senator Symington has remained on the liberal side in the civil-rights controversy and has concentrated his guns on defense and preparedness. He is generally considered moderate in viewpoint.

Overall since 1820 in presidential elections, Missouri has voted the Whig ticket 0 times, the Democratic ticket 27 times, and the Republican ticket 8 times. This compares to Indiana which has voted the Whig ticket twice, the Democratic ticket 14 times, and the Republican ticket 19 times; and Illinois which has voted the Whig ticket 0 times, the Democratic ticket 17 times, and the Republican ticket 18 times.¹⁵

Whereas the rivers tended to link Missouri more to the South, the roads and railroads linked Missouri to the Midwest. One of the earliest roads in Missouri, Boone's Trace, connected the border of Illinois with the interior of Missouri. Missouri's main trails to the West, the Santa Fe and the Oregon, also crossed Kansas. The National Road, begun shortly after 1800, connected Maryland, Virginia, Ohio, Indiana, Illinois, and Missouri when completed to St. Louis in 1850. When railroads came into vogue, the Ohio and Mississippi railroad was built to connect Cincinnati to St. Louis. Begun in 1852, the first 26 miles were completed two years later. Lack of money delayed its completion until 1857. The later main railroads in Missouri, such as the Missouri Pacific, tended to run east and west, connecting Missouri to the Midwest rather than to the South.¹⁶

When the Civil War came, the Midwest was generally in favor of saving the Union. There was, however, a strong sympathy for the South in certain sections of Missouri, southern Illinois, Indiana, and Ohio. In all these areas, it was touch and go for a time. Ohio refused to re-enact personal liberty laws in 1860 in an attempt to placate the South. Thomas Corwin of Ohio was the chairman of the "Committee of 33" instituted in 1860 to prevent secession. They proposed an amendment to guarantee slavery in the South forever and Ohio ratified

¹⁵Hammond's Historical Atlas (Maplewood, New Jersey, 1957), A29-A31.

¹⁶Seymour Dunbar, A History of Travel in America (Indianapolis, 1915), III, 1087-96; IV, 1125-60.

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it. Clement L. Vallandigham, U.S. Representative from Dayton, was violently opposed to fighting the South and he had considerable support. Copperheadism was still present in Ohio in 1864. Southern Indiana had a similar organization, the Knights of the Golden Circle, which later changed its name to the Order of American Knights and later still to the Sons of Liberty. Southern Illinois was openly sympathetic to the South in early 1861. Senator Stephen A. Douglas used his influence to keep it Union.

Because of its slave orientation, Missouri had an even greater struggle in remaining Union. In February 1861, Missouri had a convention to decide on what course to follow. A resolution favoring war against the Union was defeated, and a decision was postponed. Governor Claiborne F. Jackson, however, took steps to secede. On the other hand, Frank P. Blair organized the Wideawakes, Republican marching groups, to protect the St. Louis arsenal. In April and May of 1861, the Wideawakes were mustered into federal service in lieu of the state militia that Jackson would not provide. Nathaniel P. Lyon, commanding the federalized Wideawakes, captured the state militia at Camp Jackson and a local civil war ensued. The state assembly met in night session, created a state army, and gave the governor virtual dictatorial powers. In August 1861, Lyon attacked the state forces under Sterling Price. Assisted by Arkansas troops, Price defeated Lyon. Meanwhile, the moderates seized control and elected Hamilton R. Gamble as provisional governor. Price marched north in Missouri and won at Wilson's Creek and Lexington, but retreated before federal troops led by General John C. Fremont. In October 1861, an assembly called by Jackson declared Missouri's secession from the Union. But the defeat of Price, commanding the state army, and the defeat of the Confederates at Pea Ridge in northwest Arkansas, crushed Jackson's hopes of reestablishing his government in Missouri. Although raiding in Missouri continued, Missouri remained substantially loyal to the Union. In all, the state supplied around 110,000 troops to the Union armies and 50,000 to the Confederate cause.¹⁷

In literature Missouri again demonstrated a compromise of South and West. Its most noted author, Samuel L. Clemens

¹⁷Jay Monaghan, Civil War on the Western Border 1854-1865 (Boston, 1955), 129-239; Ralph R. Rea, Sterling Price: The Lee of the West (Little Rock, Arkansas, 1959), 32-75.

(Mark Twain), was born in Florida, Missouri, in 1835. His parents soon moved to the river town of Hannibal where he spent his boyhood. His experiences in this river town gave him a background for his two most popular books, The Adventures of Tom Sawyer and The Adventures of Huckleberry Finn. At an early age, he worked as a printer in Hannibal, St. Louis, New York, and Philadelphia. He next apprenticed himself to a steamboat pilot and eventually became an experienced pilot, but the Civil War halted traffic on the Mississippi. Some of his experiences as a pilot on the river are related in Life on the Mississippi. He spent two weeks with a troop of Confederate volunteers, then deserted and went west with his brother. After considerable wandering, he eventually settled in New York. He was the epitome of American satire, exaggeration, and humor.¹⁸

In art, Missouri produced two especially outstanding painters, one of whom represented more the South and the other the Midwest. In 1819 George C. Bingham was brought to Missouri by his family at the age of eight. He attended the Pennsylvania Academy for a short time and then returned to Missouri to paint. Some of his paintings included "Fur Traders Descending the Missouri," "The Jolly Flatboatmen," and "Raftsmen Playing Cards." His two most noted pictures were "The County Election" and "The Verdict of the People," which displayed democracy in action. His most dramatic picture was "Order No. 11," which was a protest against the federal order stripping western Missouri of all produce in order to stop Confederate guerillas operating in the region.

In more recent times, Missouri's Thomas H. Benton, along with Kansas's John S. Curry and Iowa's Grant Wood, have comprised the Midwest's outstanding triumvirate of regional painters. Benton's preachers, racketeers, gamblers, cowboys,

¹⁸ Albert B. Paine, Mark Twain: A Biography: The Personal and Literary Life of Samuel Langhorne Clemens (New York, 1912), I, 26-31, 116-21, 163-70, 281-85; II, 547-50, 745-48; IV, 1333-39. Other important Missouri authors included Eugene Field, newspaperman and author of the Little Book of Western Verse; Winston Churchill, author of The Crisis and Richard Carvell; and Richard Lockridge, creator of the mystery hunters, Mr. and Mrs. North. Robert H. Elias, Theodore Dreiser: Apostle of Nature (New York, 1949), 37; Indianapolis, Indiana, Sentinel, September 9, 1901, p. 5, c. 3.

Indians, farmers, lumbermen, and stripteasers all writhed and pranced in similar fashion. The color oppositions, the pitting of one vortex of energy against another, and the bulging muscles were his forte. Benton's scenes were representative of the vibrancy of the Midwest.¹⁹

Missouri is a composite of the Midwest and the South. In location, it is midwestern. Because it is a part of the Missouri-Ohio-Mississippi drainage basin, it was originally explored and settled by the French and Spanish. Under the United States after 1803, its later exploration and settlement were accomplished simultaneously with the western north-central states by the same explorers and by a similar type of people. However, its population came more heavily from the South than the rest of the Midwest's did. Missouri's Indian population (Pawnee, Wichita, Caddo, Arikara, Mandan, Iowa, Kansa, Missouriia, Omaha, Ponca, Osage, and Dakota) were of the same stock as those found in the western Midwest. Modern transportation facilities also have tended to tie Missouri more to the Midwest, although historically the river traffic tied Missouri to the South.

On the other hand, Missouri in the Civil War took an even more favorable attitude toward the deep South than Kentucky and Maryland. Missouri's desire to be admitted as a slave state certainly displayed a southern attitude. In voting in national and state elections, Missouri has tended to be predominantly Democratic and southern in viewpoint.

Yet again, Missouri's outstanding politicians have been a compromise between South and Midwest. And in literature and art, Missouri has also displayed this split personality. It is nearly impossible to add up all these points, pro and con, and arrive at a conclusion as to which region Missouri belongs in. By geographical location, Missouri is midwestern, but by temperament, Missouri is much more difficult to categorize. Over the years, Missouri has become increasingly midwestern, but even yet, Missouri is in that indefinite position of being either one of the most northern of the southern states or the most southern of the midwestern states.

¹⁹ Oliver W. Larkin, Art and Life in America (New York, 1949), 218-21, 414.

STATE PARTY ACTIVITY IN A TWO-PARTY ENVIRONMENT: THE DEMOCRATIC PARTY OF INDIANA

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The Democratic Party of Indiana operates in a state marked by its liking for politics. Although both the Democratic and Republican Parties participate vigorously and hopefully in political competition, the Democratic Party since 1896 has become the second party in the state. This study will examine the role of the Indiana Democratic Party as a state party, but not as a confederate member of a national party system or as a party organized at the local political levels of the state. Interest will be focused on party activity, mainly from 1952 through 1958.

The State Convention, meeting every two years, is one state party institution, but it exhibits no permanence.¹ The State Central Committee, consisting of two members from each of Indiana's eleven congressional districts, is declared by law to be "the highest party authority."² During the tenure of State Chairman Charles Skillen this Committee met at least eight times a year, often in conjunction with other party agencies.³ In addition to selecting its own officers at reorganizational meetings every two years it arranged for such party functions as the State Convention and the annual Jefferson-Jackson Dinner. The Committee also made general plans for campaign finance and strategy. However, the Committee itself was not a permanently functioning body either.

Permanency of party at the state level was found in the state party headquarters and in the officer corps of the Committee, selected by the Committee itself. These headquarters were located in four rooms of the Claypool Hotel in Indianapolis. The State Chairman and Vice-Chairman were considered full-time staff members, but the Secretary and Treasurer were not. In addition there were usually three secretaries and a stock

¹The Convention's importance lies with its power to nominate all candidates for statewide office.

²Indiana. State Election Board. Election Laws of Indiana (Primary Election) (Indianapolis, 1952), p. 77.

³Meeting, for instance, with the State Convention, the National Committee, the Jefferson-Jackson Dinner. Interview with Charles Skillen, September 1, 1959.

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clerk on duty. Extra personnel, partly consisting of candidates for state office, were assembled during campaigns.⁴ At the close of 1958 the Chairman was being paid \$694.48 monthly, the Vice-Chairman \$345.53, the Secretary \$187.11, and four secretaries' and clerks' salaries ranging from \$226.23 to \$285.52.⁵ Net salaries of employees for a period of thirty-one months amounted to \$72,435.94. Office rent for the same period was \$7,732.86.⁶

Auxiliary groups aiding the State Committee on a state-wide level were the Indiana Democratic Editorial Association, the Indiana Women's State Democratic Club, and the Young Democrats of Indiana. The IDEA held two annual meetings which attracted politicians and generated political activity.⁷ The Women's Club was helpful to party efforts during campaigns and helped raise party funds.⁸ The Young Democrats were more noted for county activity, but held a state convention every two years which brought political leaders together.

The more noticeable aspects of state party activity can be observed when Indiana Democrats are waging general election campaigns. The State Committee, delegating power to the State Chairman, and making use of other state party agencies, performs the vital role of coordinating state campaign activity. The state party cannot avoid contact with the national party or the local party groups in Indiana, particularly when candidates for national, state, and local office are simultaneously engaged in campaign efforts. Also the state party may desire close cooperation with these other levels of party, particularly if such cooperation results in votes needed to elect the state ticket. Nor could a state party detach itself from national and local political issues, even if this was desired.

The coordination of campaign efforts sought by the State

⁴Interview with Patty Fox, June 18, 1960.

⁵Report of Eugene B. Crove, Treasurer, Indiana State Central Democratic Committee, for the period May 16, 1958 - November 15, 1958 (in the Treasurer's records).

⁶Treasurer's records for the period June 1, 1956 - December 31, 1958 (in State Committee office).

⁷Speakers from time to time were Harry S. Truman, Governor G. Mennen Williams of Michigan, National Democratic Chairman Paul Butler, and United States Senators Olin Johnston and Frank Church.

⁸In the 1956 and 1958 campaigns the women's groups raised \$2,480.55.

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Committee may also be applied to the various elements within the campaign at the state level itself. Ordinarily the Indiana campaign is centered around the race for Governor in presidential election years, or around the ticket-leader in non-presidential years.⁹ The gubernatorial candidate usually operates through the state party headquarters. However, this may not always be the case. In 1956, due to differences of opinion between the gubernatorial candidate and the State Chairman, the former opened a separate campaign headquarters and named his own manager.¹⁰ The resulting splintering of campaign efforts was followed by a more exact coordination of efforts in 1958 so that the nominee for U. S. Senator and other state and congressional candidates pledged that their campaigns would be coordinated with the state headquarters.¹¹

A general coordination of state campaign efforts meant that teamwork was practiced, but complete teamwork would not have been considered practical if it had meant that all state candidates should be together at all times. There were occasions that called for community efforts on the part of office-seekers; there were other occasions that did not. If a presidential candidate visited the state he was likely to attract most state candidates to one location.¹² The Indiana appearance of former President Harry S. Truman in 1958 also brought the state ticket to Fort Wayne to officially open the campaign. The ticket-leader also planned general campaign circuits about the state, and it was agreed that other congressional and state candidates would join him in specific localities.¹³ But otherwise candidates for state office, including the ticket-header, were engaged in individual campaign efforts and might seldom encounter their fellow candidates on the campaign trail. This individual activity particularly marked Hoosier campaigns. These activities were in general coordinated through a speak-

⁹In non-presidential years the ticket-leader would be the nominee for United States Senator or Secretary of State.

¹⁰The Chairman had opposed the candidate's nomination originally. They were later divided over the size of the campaign budget after the candidate could not muster enough strength to oust the Chairman.

¹¹Louisville Courier-Journal, July 11, 1958.

¹²Adlai Stevenson accomplished this with Indianapolis speeches in 1952 and 1956.

¹³See Louisville Courier-Journal, July 11, 1958, for overall 1958 campaign strategy.

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er's bureau located in state party headquarters in the sense that speakers, particularly the ticket-header, were allocated to the county party organizations in view of overall campaign strategy, and secondly in view of local demands for speakers.

Party meetings participated in by state candidates in the localities took the form of township, ward, county, and congressional district rallies, teas, barbecues, fishfrys, breakfasts, picnics, and automobile caravans. Candidates also made political remarks before special interest groups consisting of veterans, labor union members, businessmen, dairy-men, and municipal officials.

Assistance to Indiana campaign efforts came from outside sources when Democrats, not then candidates for any office spoke at political rallies. United States Senators Estes Kefauver, John Sparkman, John Kennedy, Hubert Humphrey, Lyndon Johnson, and Frank Church were particularly active in the 1956 and 1958 campaigns.

The months of September and October were marked by many speeches under various sponsors throughout the state. A pattern of gradual buildup to election eve in November was featured.¹⁴

The second major aspect of state party activity was that of distributing political literature and providing for other party publicity. The state headquarters often acted as middleman when it simply passed on to county organizations literature concerned with national issues which had come from the Democratic National Committee. On occasions the state headquarters distributed pamphlets paid for by wealthy county party organizations. Then there were pamphlets concerned with state issues produced by either the State Committee itself or campaign groups which had been set up especially to elect a Governor or United States Senator.¹⁵ The State Committee itself produces a standard campaign handbook containing the State party platform, messages from the State Chairman and Vice-Chairman, and pictures or biographical data on national, con-

¹⁴ See particularly the Indiana Democrat for September and October of 1956, and the Indiana Sentinel for the same months of 1958 for a general view of such activity.

¹⁵ "John A. Watkins for Governor," Watkins for Governor Club Inc., 1952 (in writer's collection), and "Confidential Fact Sheet" Hoosiers for Hartke, October 23, 1958 (in writer's collection).

gressional, state, and legislative candidates.¹⁶ In addition, divisions within the state party headquarters made printed appeals to special groups of voters.

The State Committee also relied upon posters and billboard displays for publicity purposes. The combined cost for this type of publicity in the two general election campaigns of 1956 and 1958 was \$83,189.87. In the same two campaigns the State Committee spent \$90,393.95 for radio and television time.¹⁷ A public relations firm was being paid \$477.15 monthly at the close of 1958 for its aid in gaining publicity for the Democratic Party.¹⁸

The newspaper is a potential source of party publicity, both during election campaigns and between campaigns. However, of eighty-seven daily newspapers published in Indiana in 1958 only eighteen were called Democratic. Only six of the eighteen Democratic dailies had circulations of over 5,000; only one over 20,000. The Democratic Party had no newspaper with a circulation comparable to the combined circulation of the Republican house organs, the Indianapolis Star and News, which stood at 377,116.¹⁹

It was possible that a Democratic newspaper could have existed in every county, subsidized by state laws requiring that election notices, legal notices, and financial notices of some governmental units be published in two newspapers of opposite political affiliation.²⁰ This device could particularly be used to help support a weekly newspaper. Even so, of two hundred and eighty-five weekly, tri-weekly, or semi-weekly newspapers existing in 1958, only one hundred were Democratic. The largest circulation of a Democratic weekly was 30,143.²¹ Some of these Democratic dailies and weeklies had strange relationships with the Republican Party inasmuch as the same publisher, in order to be subsidized by govern-

¹⁶"Indiana Democratic Candidates and Principles," Indiana Democratic State Central Committee, 1958 (in writer's collection).

¹⁷Treasurer's records for the period June 1, 1956 - December 31, 1958 (in State Committee Office).

¹⁸Ibid., and Louisville Courier-Journal, August 6, 1960.

¹⁹Directory of Newspapers and Periodicals (Philadelphia: N. W. Ayer and Son, Inc., 1958), pp. 311-339.

²⁰See, for example, Indiana. State Election Board. Election Laws of Indiana (Primary Election) (Indianapolis, 1952), p. 164.

²¹Directory of Newspapers and Periodicals (Philadelphia: N. W. Ayer and Son, Inc., 1958). pp. 311-339.

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mental agencies, would own two county newspapers, labeling one Democratic; the other Republican.

The State Committee itself published a four-page newspaper called Chanticleer for party workers, but the publication lasted less than a year. In Marion County (Indianapolis) two Democratic newspapers, first the Indiana Democrat and later the Indiana Sentinel, gave the national and state Democratic Parties a good bit of publicity during the 1956 and 1958 campaigns. Party activities were highlighted, editorials and Herblock cartoons were featured, and during campaigns, speeches of state candidates were reported. However, the Sentinel's circulation stood at only 8,800, and there is no indication that the State Committee subsidized these newspapers with political advertisements during campaigns. The main role of the press in Indiana, as far as the Democratic Party is concerned, has been to provide a medium from which political leaders might be chosen, particularly through IDEA activities. The 1952 candidate for Governor was a newspaper publisher, while Henry F. Schricker, Indiana's only two-term Governor, had also been active in the newspaper world.

Generally, the outside limits of political party activity are set by available financial resources.²² How much money could be raised by the Democratic State Committee in Indiana? For the thirty-one-month period from June 1, 1956 through December 31, 1958 the financial intake of the Committee was \$418,977.77. This period covered two general election campaigns. From May 16 through November 15, 1958 the Committee was able to raise \$140,830.00 for the fall campaign. The best months for collecting funds in 1958 were October, June, and September, in that order, when \$122,055.85 was raised.

Another question is where did the collected funds come from? A breakdown of contributions from June 1, 1956 through December 31, 1958 shows that \$376,028.89 of the total \$418,977.77 came from nine distinct sources. The largest source was the County Committees which gave nearly one-fourth of the funds collected, or a total of \$90,083.86. The receipts from the annual Jefferson-Jackson dinners furnished the second largest sum (\$70,360.00). Candidate assessments at the State Convention made up the third greatest source (\$51,950.00), individual or general contributions fourth

²²The sources used for examination of financial activity are cited in footnotes 5 and 6 above.

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(\$49,656.32), and fees levied against State Convention delegates fifth (\$40,540.00).²³

Contributions from individuals made up the fourth largest source of State Committee income, but only about one-eighth of the total. These individual contributions were not highly concentrated. During the May through November 1958 campaign period there were twenty-five persons who made contributions of \$200.00 or more, but only two of these persons made total contributions of \$500.00 or more.²⁴ All contributions from individuals of \$200.00 or more made up only \$6,700.00 of the total \$140,830.00 collected by the committee during this 1958 period. The individuals making these contributions included a State Committee officer, a former National Chairman, a former Governor, two former District Chairmen, a Mayor, a former County Chairman, and an Indianapolis attorney.

How did the State Committee spend the money it raised? For the thirty-one-month period, from June 1, 1956 through December 31, 1958, \$423,731.01 was spent. Of this total, \$269,274.34 was expended on five items -- radio and television time (\$90,393.95), net salaries (\$72,435.94), posters (\$54,106.20), billboards (\$29,083.67), and contributions to the Democratic National Committee (\$23,254.58).

In viewing the vigorous activity of the Indiana Democratic Party at the state level, particularly through campaign travels and speeches and rallies, through publicity purposes, and through general financial activity one could conclude that the Indiana Democracy was a serious contender for state office from 1952 through 1958. But while it did not fail to match the Republican Party in vigor, it lacked the patronage advantages that the Republican Party had in the state and nation. After 1952 Indiana Democrats had to rely mainly on courthouses and city halls for patronage.

The Democrats failed to match the Republican ability to raise campaign funds also. In 1958 during a period of time when the Democratic State Committee raised \$140,830.00 for campaign purposes the Republican State Committee raised \$575,636.89. This disparity of income was in large part responsible for a disparity in office personnel and in the ability

²³The other four large sources were Dollars for Democrats, the 1958 Truman Dinner, the Hoosiers for Hartke Club, and assessments of National Convention delegates.

²⁴One was for \$500.00; the other for \$700.00.

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to purchase publicity. The office staff of the Republican Committee stood at thirty-three or more at the height of the 1958 campaign, while the Democrats had only a few volunteer workers in addition to their usual three secretaries and a clerk.²⁵ The Republican State Committee spent \$464,423.62 for various campaign programs and publicity devices from May through November of 1958, while during the two general election campaigns of 1956 and 1958 and the city campaigns of 1955 the Democratic State Committee spent only \$203,577.96 for similar items.²⁶ So finally, these limitations on Democratic activity would have to be considered in any evaluation of the effectiveness of Democratic Party campaigns as compared to those of the opposition.

²⁵ Interview with Republican worker, June 18, 1960.

²⁶ The Democratic financial records, listed above, are here compared with the report of the Treasurer of the Republican State Committee, May 11, 1958 - November 18, 1958 (in County Clerk's Office, Marion County, Indiana).

AN APPLICATION OF THE THEORY OF SOCIAL MOBILIZATION TO ARKANSAS

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The purpose of this paper is to apply to Arkansas the theory of social mobilization developed by Dr. Karl W. Deutsch of Yale University and the Fletcher School of Law and Diplomacy. First, I wish to briefly summarize the theory, then discuss difficulties encountered in applying it to an intranational region and, finally, illustrate its use in regard to Arkansas.

The theory of social mobilization.¹ The concept of social mobilization is employed in connection with Professor Deutsch's communicative approach to nationalism. While this approach is not my concern today, an understanding of its salient points is required as background.

Dr. Deutsch contends that communication plays a major role in molding divergent peoples into a modern nation-state; conversely, groups disunite because of a communicative rupture. "Communication" is interpreted broadly and includes more than spoken and written messages (such as exchanges of mail, diplomatic correspondence, newspapers, and listening to radio broadcasts). The term also denotes commercial intercourse, visits by heads of state, reciprocal tourist travel and other activities which expose one group to the other. Communication reinforces other factors which also create national consciousness (such as race, culture, geography, fear of common enemies). The citizens begin to experience the mystical spirit of brotherhood and take pride in their common heritage. Thus, Hans Kohn rightly describes nationalism as a "state of mind."²

¹The writer's knowledge of social mobilization comes from Dr. Karl W. Deutsch's book, Nationalism and Social Communication (New York: John Wiley and Sons, Inc., 1953), his mimeographed essay entitled "Social Mobilization and Political Development" and his lectures at the Fletcher School of Law and Diplomacy.

²Hans Kohn, Nationalism -- Its Meaning and History (Princeton, N.J.: D. Van Nostrand, 1955), p. 9.

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How is the theory of social mobilization relevant to this development? Deutsch contends that communication influences only a particular segment of the population: The mobilized citizenry. As a country transverse the path from primitive to advanced status and traditional ways of life are jettisoned, the mobilized population multiplies. The workings of this process is described by Professor Deutsch as "major clusters of old social, economic and psychological commitments are eroded and broken and people become available for new patterns of socialization and behavior."³ Citizens engaged in this process are the mobilized population and become the nucleus for a modern nation-state.

What are the characteristics of this process? Deutsch turns to statistics to describe -- and measure -- social mobilization. He lists several indices: urban population; population engaged in occupations other than agriculture, forestry and fishing; literate population; student population; various economic indicators (e.g., gross national product and per capita income); and, of course, total population. Other time series are included, but these should serve for illustration purposes.

At this point, Deutsch assumes (and there is no reason to question this assumption) that a literate, urbanized citizen engaged in industry is more receptive to mass communication than the illiterate farmer of the hinterland. The literate industrial worker living in the city will be more interested in his government and directing his own country's destiny. He represents the socially mobilized sector of the population. Obviously, the intelligencia is included in this sector.

Therefore, the concept of social mobilization can be summarized as follows: a primitive society will undergo various changes as it develops into one that is advanced; these modifications allow communication to be effective in fusing divergent groups together into a modern nation-state; and it is possible to study statistically the characteristics of this development. Needless to say, the theses of Deutsch are controversial

³Karl W. Deutsch, "Social Mobilization and Political Development," mimeographed, p. 3.

among social scientists.⁴

Difficulties in applying social mobilization to Arkansas. The difficulties encountered in applying social mobilization to Arkansas are summarized under three headings.

(1) Application of a concept of international relations to an intranational region.

This attempt is not the first endeavor to apply a concept of international relations to Arkansas.⁵ Nor is social mobilization exclusively used by Deutsch to study independent nation-states, but is employed in analyses of international regions as well.⁶

However, the Arkansas historian who finds social mobilization unpalatable may borrow the mechanics of the theory while rejecting the spirit. By this I mean that Deutsch's indices could be employed to supplement the traditional approach of the study of Arkansas history. Statistical time series would bring to light trends occurring decades preceeding a historical happening. These trends are usually imperceptible changes

⁴Two critics of Deutsch are David Potter and Stanley Hoffman. Potter, the author of People of Plenty: Economic Abundance and the American Character (Chicago: University of Chicago Press, 1954), mildly points out that culture is still basic: communication can be studied only as an outgrowth of the "culture concept." Furthermore, he correctly states that measurement of communication in primitive societies is a difficult task. On the other hand, Hoffman scathingly attacks the "systems theory" of international politics in his book, Contemporary Theory in International Relations (Englewood Cliffs, N. J.: Prentice Hall, Inc., 1960). He contends that the methods of the sciences cannot be readily applied to international relations; that models are a "strange form of parlor games;" that predictions are impossible for international politics. He singles out Deutsch for criticism and declares that some communications are more important than others (e.g., diplomatic correspondence verses daily newspaper clippings). But Hoffman is impartial in his lashings: he is equally as harsh with other approaches to the study of international relations.

⁵Vance Q. Alvis, "Some Problems in the Construction of a Balance of Payments for an Intranational Region," Arkansas Academy of Science Proceedings, V (1952), 103-106.

⁶Here I have particularly in mind Professor Deutsch's study of Bohemia, Nationalism and Social Communication (New York: John Wiley, 1953), pp. 107-108, 116-122, 183-196.

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transpiring below the surface of history and emerging as civil wars, policy changes, or outcome of strategic elections. While historians are well acquainted with time series, Deutsch's combination of indices and their correlation presents a new tool for research in the social sciences.

It is unfortunate indeed that political scientists and historians have allowed other fields, such as economics and psychology, to monopolize the statistical approach to research.⁷

(2) The necessity of a multidisciplinary outlook.

A second difficulty in applying social mobilization to Arkansas is the demand placed on the student to be multidisciplinary in his thinking. He must be acquainted with fundamentals of economics and sociology in addition to history and political science as statistics are gathered and interpreted.

(3) Availability of statistics on Arkansas.

Arkansas statistics are on the proverbial feast and famine basis.

The drought exists with economic data. Per capita income and personal income statistics for Arkansas are available only since 1929 and the figures are not expressed in constant dollars but in current dollars which are distorted by inflation. Unfortunately, a state's equivalent of national income and gross national product figures do not exist.⁸

Population statistics present a different story, thanks to the Bureau of the Census. Some evaluation of this material has been published.⁹

⁷A concise introduction to the statistical approach is V. O. Key, Jr., A Primer of Statistics for Political Scientists (New York: Thomas Y. Crowell Company, 1954).

⁸Evidently a beginning has been made as evidenced by Robert M. Soldofsky, "Methods and Problems in the Measurement of Economic Changes in States," Arkansas Academy of Science Proceedings, V (1952), 99-102. Also, see Richard A. Easterlin, "Long Term Regional Income Changes: Some Suggested Factors," Papers and Proceedings of the Regional Science Association, IV (1958), 313-325. However, economists at the Arkansas Industrial Development Commission and the Industrial Research and Extension Center were not aware of extensive research in this area.

⁹For background knowledge, consult John B. Mitchell, "An Analysis of Arkansas' Population by Race and Nativity, and Residence," The Arkansas Historical Quarterly, VIII (Summer, 1949), 115-132.

Arkansas and social mobilization. Attached to this paper is a three-cycle semi-logarithmic graph on which the following indices of social mobilization are plotted: total population, white and Negro population, total student enrollment, white and Negro student enrollments, and rural and urban population. Some of the time series begin in 1880, others at later dates.

A detailed study of the cause-and-effect relationship between these indices and historical events would be interesting. However, as an international politician, I must give deference to the specialist acquainted with the niceties of Arkansas history. Examples of the questions an Arkansas historian would seek to answer are: What government policies influenced, or were influenced by, the development of a mobilized population? How does the mobilized population of Arkansas compare with neighboring states? Has the increase in mobilized population resulted in more interest and participation in politics? Does an extrapolation of social mobilization trends yield a glimpse of future events? (For instance, the increasing urban population and the decreasing rural population indices will intersect before 1970. An Arkansas population which is over 50 percent urbanized will, no doubt, leave its mark on the political and economic framework of the state.)

Additional questions are usually raised in using Deutschian analysis. To illustrate, the three-cycle semi-logarithmic graph portrays Arkansas' well-known loss of population, a loss which prompted that famous tongue-in-cheek remark by Business Week: "... in the long run, Arkansas' most significant export of all may prove to be people."¹⁰ Indubitably, part of the drain is out-migrating Negroes not counterbalanced by Negroes moving into Arkansas.¹¹ Also, young whites are leaving, as a recent study by economists Brown and Peterson of the Industrial Research and Extension Center shows: "Most of the migrants from Arkansas . . . have been young adults and very young children."¹² As yet no recognition has been given to the undetermined number of whites who are moving into the

¹⁰"Why Do Arkansans Vanish?," Business Week (April 12, 1958). 96.

¹¹"Census Portrays Shift of Negroes," New York Times, March 8, 1961, p. 26.

¹²Phillips H. Brown and John M. Peterson, "The Exodus from Arkansas," The Arkansas Economist, II (Winter, 1960), 11.

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state; evidently these are older citizens, most of whom are retiring. This has resulted in a pronounced aging trend for Arkansas which can be measured by two statistical indicators.

One indicator¹³ is the percentage of total population over 65 years of age. In the United States, this percentage has doubled between 1890 and 1950 while it has quadrupled in Arkansas for the same period of time.

Another indicator¹³ is median age for white population. In Arkansas, the white's median age rose from 17.4 years in 1880 to 27.6 years in 1950: an increase of 58.6 percent. For the United States, an increase of 43.9 percent was recorded with the median age rising from 21.4 to 30.8 years. A social scientist could formulate interesting observations of the impact of this aging trend on future economic and political developments in Arkansas.

(1) Economically, new demands will be placed on the state government by a growing segment of the population wanting more services for the aged. At the same time, this segment will not contribute current goods and services to the state's economy since its primary source of income is transfer payments (an economist's term which includes social insurance and other retirement income). An adverse effect on the state's economy will not be felt until ten percent of the total population is forced to retire.¹⁴ Arkansas presently has 7.9 percent of her total population (white and non-white) aged 65 and over although it is doubtful that all are fully retired.

(2) Politically, an increase in older citizens will probably strengthen the conservative viewpoint on politics. This conclusion is based on the assumption that elders are less liberal than younger people which is a conjecture not yet proven by sociological studies.¹⁵

Conclusion. What has been attempted in this paper is to briefly describe the theory of social mobilization, which is

¹³A time series of ten-year intervals for each of these indices has been attached to this paper.

¹⁴Paul B. Horton and Gerald R. Leslie, The Sociology of Social Problems, 2nd ed. (New York: Appleton-Century-Crofts, Inc., 1960), pp. 261-262.

¹⁵T. Lynn Smith, a sociologist, declares that this assumption has not been substantiated, "although a few studies have been suggestive." T. Lynn Smith and associates, Social Problems (New York: Thomas Y. Crowell Co., 1956), p. 120.

part of Karl W. Deutsch's communicative approach to nationalism. As a nation's population is "mobilized," transformations occur within society which are measured statistically.

It is my opinion that this theory can be profitably applied to the study of Arkansas history. The difficulties encountered in this application are (a) the problem of employing a concept designed primarily for international politics to an intranational region, (b) collecting adequate statistical data on Arkansas, and (c) the demands placed on the student to be multidisciplinary in his approach.

Because the writer's field of study is international relations, the analysis of the statistical material attached to this paper must be left in the hands of the Arkansas historian. However, exploratory questions were raised and the use of social mobilization analysis illustrated by Arkansas' aging trend.

It is my sincere hope that specialists in Arkansas history will employ this tool in their study of this state's rich historical heritage.

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STATISTICS ON ARKANSAS

(Thousands)

	<u>1880</u>	<u>1890</u>	<u>1900</u>	<u>1910</u>	<u>1920</u>	<u>1930</u>	<u>1940</u>	<u>1950</u>	<u>1960</u>
Total									
Population	802	1,128	1,312	1,574	1,752	1,854	1,949	1,910	1,786
White									
Population	591	818	944	1,131	1,279	1,375	1,466	1,481	1,397
Negro									
Population	210	309	366	442	472	478	482	426	388
Rural									
Population				1,371	1,461	1,472	1,517	1,292	1,020
Urban									
Population				202	290	383	432	617	766
Total Student									
Enrollment	79	205	314	395	483	456	472*	425	424
White Student									
Enrollment		154	230	295	360	351	356*	322	317
Negro Student									
Enrollment		51	84	100	122	105	115*	102	106

*Effective in 1942 ages enumerated were changed from 6-20 to 6-17, both inclusive.

Sources: Statistical Abstract of the United States; Statistical Summary for the Public Schools of Arkansas,

AN APPLICATION OF THE THEORY OF SOCIAL MOBILIZATION

STATISTICS ON ARKANSAS

1880 1890 1900 1910 1920 1930 1940 1950

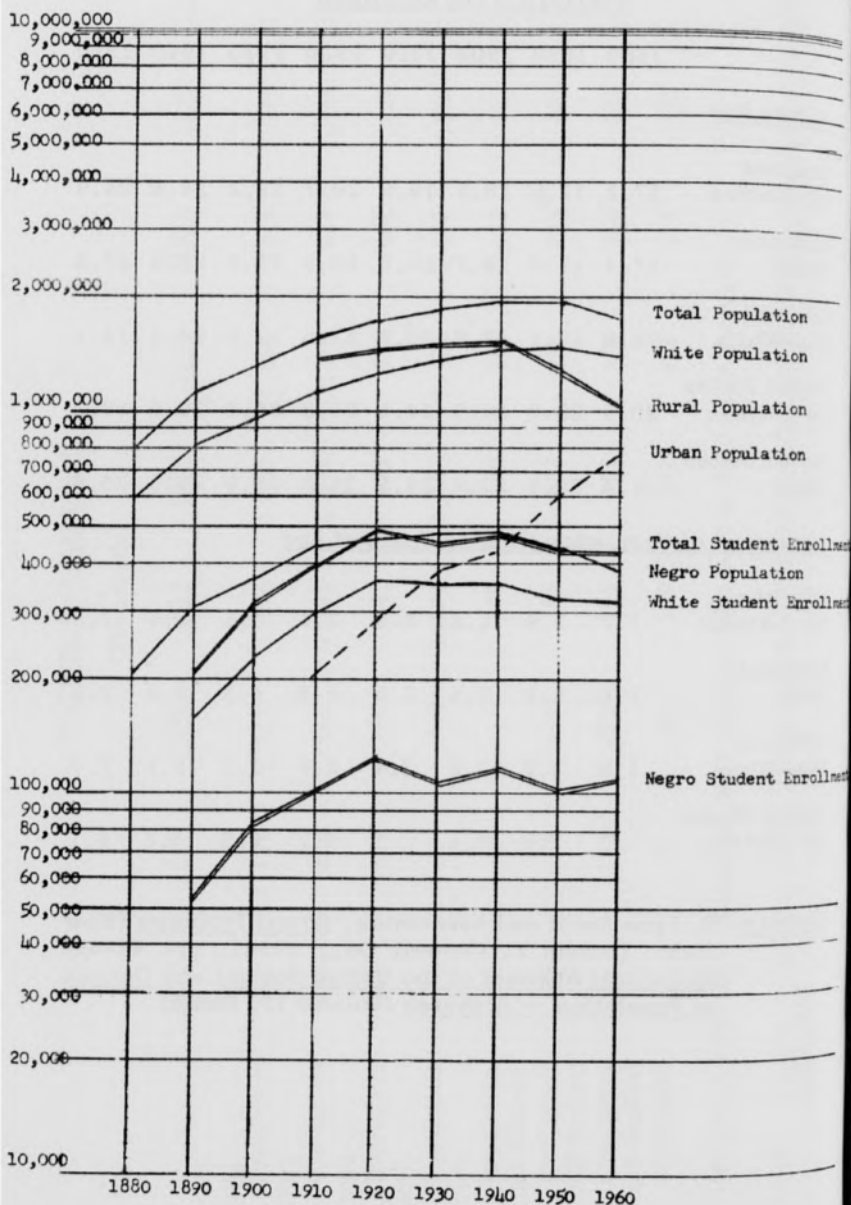
Median Age

Arkansas								
All Classes	17.2	17.6	18.7	19.8	20.7	22.2	24.8	26.9
Arkansas								
White	17.4	17.6	18.7	19.6	20.3	22.0	24.9	27.6
Arkansas								
Non-White	16.8	15.5	18.9	20.2	21.6	22.9	24.5	24.1
United States								
All Classes	20.9	22.0	22.9	24.1	25.3	26.5	29.0	30.2
United States								
White	21.4	22.5	23.4	24.5	25.6	26.9	29.5	30.8

Percentage of Population Over 65 Years of Age

Arkansas								
All Classes	1.7	1.9	2.4	2.9	3.6	4.1	5.5	7.9
Arkansas								
White	1.6	2.1	2.5	2.9	3.8	4.3	5.6	7.8
Arkansas								
Non-White	1.8	2.0	2.2	2.4	2.7	3.1	5.1	7.8
United States								
All Classes		3.8	4.1		4.7	5.5	6.8	8.1

Sources: T. Lynn Smith and Associates, Social Problems (New York: Thomas Y. Crowell Co., 1956), pp. 43-44; Statistical Abstract of the United States; and Census of Population -- Arkansas (Volume II, Part 4).



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